

# AC Servo Drives

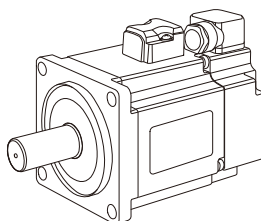
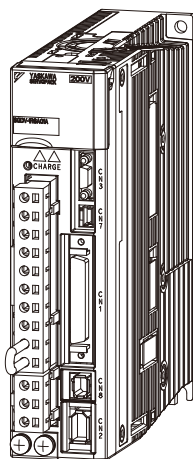
## $\Sigma$ -V Series

### USER'S MANUAL

#### Setup

#### Rotational Motor

SGDV SERVOPACK  
SGMJV/SGMAV/SGMPS/SGMGV/SGMSV/SGMCS Servomotors



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# About this Manual

This manual describes procedures required for installation, wiring, and connecting  $\Sigma$ -V Series servo drives, including a JOG operation for servomotors not connected to machinery.

Be sure to refer to this manual and perform setup operations correctly.

Keep this manual in a location where it can be accessed for reference whenever required.

## ■ Description of Technical Terms

The following table shows the meanings of terms used in this manual.

Term	Meaning
Servomotor	$\Sigma$ -V Series SGMJV, SGMAV, SGMPS, SGMGV, SGMSV, or SGMCS (Direct Drive) servomotor
SERVOPACK	$\Sigma$ -V Series SGD V SERVOPACK
Servo Drive	A set including a servomotor and SERVOPACK (i.e., a servo amplifier)
Servo System	A servo control system that includes the combination of a servo drive with a host controller and peripheral devices
Analog pulse model	Analog voltage and pulse-train reference used for SERVOPACK interface.
M-II model	MECHATROLINK-II communications reference used for SERVOPACK interface.

## ■ IMPORTANT Explanations

The following icon is displayed for explanations requiring special attention.



- Indicates important information that should be memorized, as well as precautions, such as alarm displays, that do not involve potential damage to equipment.

## ■ Notation Used in this Manual

In this manual, the names of reverse signals (ones that are valid when low) are written with a forward slash (/) before the signal name, as shown in the following example:

Example

$\overline{\text{S-ON}}$  = /S-ON

## ■ Manuals Related to the $\Sigma$ -V Series

Refer to the following manuals as required.

Name	Selecting Models and Peripheral Devices	Ratings and Specifications	System Design	Panels and Wiring	Trial Operation	Trial Operation and Servo Adjustment	Maintenance and Inspection
$\Sigma$ -V Series Product Catalog (KAEP S800000 42)	✓	✓					
$\Sigma$ -V Series User's Manual Design and Maintenance Rotational Motor/ Analog Voltage and Pulse Train Reference (SIEP S800000 45)		✓	✓	✓		✓	✓
$\Sigma$ -V Series User's Manual Design and Maintenance Rotational Motor/ MECHATROLINK-II Communications Reference (SIEP S800000 46)		✓	✓	✓		✓	✓
$\Sigma$ -V Series User's Manual Operation of Digital Operator (SIEP S800000 55)					✓	✓	✓
$\Sigma$ -V Series User's Manual MECHATROLINK-II Command (SIEP S800000 54)			✓		✓	✓	
$\Sigma$ -V Series AC SERVOPACK SGD V Safety Precautions (TOBP C710800 10)	✓			✓			✓
$\Sigma$ Series Digital Operator Safety Precautions (TOBP C730800 00)							✓
AC SERVOMOTOR Safety Precautions (TOBP C230200 00)				✓			✓

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## ■ Safety Information

The following conventions are used to indicate precautions in this manual. Failure to heed precautions provided in this manual can result in serious or possibly even fatal injury or damage to the products or to related equipment and systems.

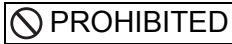



Indicates precautions that, if not heeded, could possibly result in loss of life or serious injury.




Indicates precautions that, if not heeded, could result in relatively serious or minor injury, damage to the product, or faulty operation.

In some situations, the precautions indicated could have serious consequences if not heeded.



Indicates prohibited actions that must not be performed. For example, this symbol would be used to indicate that fire is prohibited as follows: 



Indicates compulsory actions that must be performed. For example, this symbol would be used as follows to indicate that grounding is compulsory: 

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# Safety Precautions

These safety precautions are very important. Read them before performing any procedures such as checking products on delivery, storage and transportation, installation, wiring, operation and inspection, or disposal. Be sure to always observe these precautions thoroughly.

## WARNING

- **Never touch any rotating motor parts while the motor is running.**  
Failure to observe this warning may result in injury.
- **Before starting operation with a machine connected, make sure that an emergency stop can be applied at any time.**  
Failure to observe this warning may result in injury or damage to the product.
- **Never touch the inside of the SERVOPACKs.**  
Failure to observe this warning may result in electric shock.
- **Do not remove the cover of the power supply terminals while the power is ON.**  
Failure to observe this warning may result in electric shock.
- **After the power is turned OFF or after a voltage resistance test, do not touch terminals while the CHARGE lamp is ON.**  
Residual voltage may cause electric shock.
- **Follow the procedures and instructions provided in this manual for trial operation.**  
Failure to do so may result not only in faulty operation and damage to equipment, but also in personal injury.
- **The multi-turn output range for the  $\Sigma$ -V Series absolute position detecting system is different from that of earlier systems (15-bit and 12-bit encoders). In particular, change the system to configure the  $\Sigma$  series infinite-length positioning system with the  $\Sigma$ -V Series.**
- **The multi-turn limit value need not be changed except for special applications.**  
Changing it inappropriately or unintentionally can be dangerous.
- **If the Multi-turn Limit Disagreement alarm occurs, check the setting of parameter Pn205 in the SERVOPACK to be sure that it is correct.**  
If Fn013 is executed when an incorrect value is set in Pn205, an incorrect value will be set in the encoder. The alarm will disappear even if an incorrect value is set, but incorrect positions will be detected, resulting in a dangerous situation where the machine will move to unexpected positions.
- **Do not remove the front cover, cables, connectors, or optional items from the upper front of the SERVOPACK while the power is ON.**  
Failure to observe this warning may result in electric shock.
- **Do not damage, press, exert excessive force on, or place heavy objects on the cables.**  
Failure to observe this warning may result in electric shock, stopping operation of the product, or fire.
- **Do not modify the product.**  
Failure to observe this warning may result in injury, fire, or damage to the product.

## WARNING

- Provide an appropriate stopping device on the machine side to ensure safety. The holding brake on a servomotor with a brake is not a stopping device for ensuring safety.  
Failure to observe this warning may result in injury.
- Do not come close to the machine immediately after resetting a momentary power loss. The machine may restart unexpectedly. Take appropriate measures to ensure safety against an unexpected restart.  
Failure to observe this warning may result in injury.
-  Connect the ground terminal according to local electrical codes (100  $\Omega$  or less for a SERVOPACK with a 100, 200 V power supply. 10  $\Omega$  or less for a SERVOPACK with a 400 V power supply.)  
Improper grounding may result in electric shock or fire.
-  Installation, disassembly, or repair must be performed only by authorized personnel.  
Failure to observe this warning may result in electric shock or injury.
- The person who designs a system using the safety function (Hard Wire Baseblock function) must have full knowledge of the related safety standards and full understanding of the instructions in  *$\Sigma$ -V Series User's Manual Design and Maintenance* (SIEP S800000 45/46).  
Failure to observe this warning may result in injury or damage to the product.

## ■ Storage and Transportation

## CAUTION

- Do not store or install the product in the following locations.  
Failure to observe this caution may result in fire, electric shock, or damage to the product.
  - Locations subject to direct sunlight
  - Locations subject to temperatures outside the range specified in the storage/installation temperature conditions
  - Locations subject to humidity outside the range specified in the storage/installation humidity conditions
  - Locations subject to condensation as the result of extreme changes in temperature
  - Locations subject to corrosive or flammable gases
  - Locations subject to dust, salts, or iron dust
  - Locations subject to exposure to water, oil, or chemicals
  - Locations subject to shock or vibration
- Do not hold the product by the cables, motor shaft or detector while transporting it.  
Failure to observe this caution may result in injury or malfunction.
- Do not place any load exceeding the limit specified on the packing box.  
Failure to observe this caution may result in injury or malfunction.

## ■ Storage and Transportation (cont'd)

### CAUTION

- If disinfectants or insecticides must be used to treat packing materials such as wooden frames, pallets, or plywood, the packing materials must be treated before the product is packaged, and methods other than fumigation must be used.

Example: Heat treatment, where materials are kiln-dried to a core temperature of 56°C for 30 minutes or more.

If the electronic products, which include stand-alone products and products installed in machines, are packed with fumigated wooden materials, the electrical components may be greatly damaged by the gases or fumes resulting from the fumigation process. In particular, disinfectants containing halogen, which includes chlorine, fluorine, bromine, or iodine can contribute to the erosion of the capacitors.

## ■ Installation

### CAUTION

- Never use the product in an environment subject to water, corrosive gases, inflammable gases, or combustibles.  
Failure to observe this caution may result in electric shock or fire.
- Do not step on or place a heavy object on the product.  
Failure to observe this caution may result in injury.
- Do not cover the inlet or outlet ports and prevent any foreign objects from entering the product.  
Failure to observe this caution may cause internal elements to deteriorate resulting in malfunction or fire.
- Be sure to install the product in the correct direction.  
Failure to observe this caution may result in malfunction.
- Provide the specified clearances between the SERVOPACK and the control panel or with other devices.  
Failure to observe this caution may result in fire or malfunction.
- Do not apply any strong impact.  
Failure to observe this caution may result in malfunction.



## ■ Wiring

### CAUTION

- Be sure to wire correctly and securely.  
Failure to observe this caution may result in motor overrun, injury, or malfunction.
- Do not connect a commercial power supply to the U, V, or W terminals for the servomotor connection.  
Failure to observe this caution may result in injury or fire.
- Securely connect the main circuit power supply terminals and servomotor connection terminals.  
Failure to observe this caution may result in fire.
- Do not bundle or run the main circuit cables together with the I/O signal cables or the encoder cables in the same duct. Keep them separated by at least 30 cm.  
Failure to do so may result in malfunction.
- Use shielded twisted-pair wires or multi-core shielded twisted-pair wires for I/O signal cables and the encoder cables.
- I/O signal cables must be no longer than 3 m, encoder cables must be no longer than 50 m, and control power supply (+24 V, 0 V) cables for a 400 V input SERVOPACK must be no longer than 10 m.
- Do not touch the power terminals while the CHARGE lamp is ON after turning power OFF because high voltage may still remain in the SERVOPACK. Make sure the charge indicator is off first before starting an inspection.
- Observe the following precautions when wiring main circuit terminals.
  - Remove detachable main circuit terminals from the SERVOPACK prior to wiring.
  - Insert only one main circuit cable per opening in the main circuit terminals.
  - Make sure that no part of the core wire comes into contact with (i.e., short-circuit) adjacent wires.
- Install a battery at either the host controller or the battery unit of the encoder, but not both.  
It is dangerous to install batteries at both ends simultaneously, because that sets up a loop circuit between the batteries.
- Always use the specified power supply voltage.  
An incorrect voltage may result in fire or malfunction.
- Take appropriate measures to ensure that the input power supply is supplied within the specified voltage fluctuation range. Be particularly careful in places where the power supply is unstable.  
An incorrect power supply may result in damage to the product.
- Install external breakers or other safety devices against short-circuiting in external wiring.  
Failure to observe this caution may result in fire.
- Take appropriate and sufficient countermeasures for each form of potential interference when installing systems in the following locations.
  - Locations subject to static electricity or other forms of noise
  - Locations subject to strong electromagnetic fields and magnetic fields
  - Locations subject to possible exposure to radioactivity
  - Locations close to power suppliesFailure to observe this caution may result in damage to the product.

## ■ Wiring (cont'd)

### CAUTION

- Do not reverse the polarity of the battery when connecting it. Failure to observe this caution may result in damage to the battery, the SERVOPACK, or cause an explosion.
- Wiring or inspection must be performed by a technical expert.
- Use a 24 VDC power supply with double insulation or reinforced insulation.

## ■ Operation

### CAUTION

- Conduct trial operations on the servomotor alone, with the motor shaft disconnected from the machine to avoid accidents.  
Failure to observe this caution may result in injury.
- Before starting operation with a machine connected, change the settings to match the parameters of the machine.  
Starting operation without matching the proper settings may cause the machine to run out of control or malfunction.
- Do not frequently turn power ON and OFF.  
Since the SERVOPACK has a capacitor in the power supply, a high charging current flows when power is turned ON. Frequently turning power ON and OFF causes main power devices like capacitors and fuses to deteriorate, resulting in unexpected problems.
- When using JOG operations (Fn002) origin search operations (Fn003), or EasyFFT operations (Fn206), the dynamic brake function does not work for reverse overtravel or forward overtravel. Take necessary precautions.  
Failure to observe this caution may result in damage to the product.
- When using the servomotor for a vertical axis, install safety devices to prevent workpieces from falling due to alarms or overtravels. Set the servomotor so that it will stop in the zero clamp state when overtravel occurs.  
Failure to observe this caution may cause workpieces to fall due to overtravel.
- When not using turning-less function, set to the correct moment of inertia ratio (Pn103).  
Setting to an incorrect moment of inertia ratio may cause vibration.
- Do not touch the SERVOPACK heatsinks, regenerative resistor, or servomotor while power is ON or soon after the power is turned OFF.  
Failure to observe this caution may result in burns due to high temperatures.
- Do not make any extreme adjustments or setting changes of parameters.  
Failure to observe this caution may result in injury or damage to the product due to unstable operation.
- When an alarm occurs, remove the cause, reset the alarm after confirming safety, and then resume operation.  
Failure to observe this caution may result in damage to the product, fire, or injury.
- Do not use the holding brake of the servomotor for braking.  
Failure to observe this caution may result in malfunction.

## ■ Operation (cont'd)

### CAUTION

- Always use the servomotor and SERVOPACK in one of the specified combinations.  
Failure to observe this caution may result in fire or malfunction.
- The servomotor stopping method of turning the main-circuit or control-circuit power OFF without turning the servo OFF during operation can not be set in Parameter Pn001. Use the following method to stop the servomotor.
  - When turning the main-circuit power OFF without turning the servo OFF:  
The servomotor will be stopped by dynamic braking (DB).
  - When turning the control-circuit power OFF without turning the servo OFF:  
The stopping method will vary depending on the SERVOPACK model.  
Refer to the  $\Sigma$ -V Series User's Manual Design and Maintenance for details.

## ■ Maintenance and Inspection

### CAUTION

- Do not disassemble the SERVOPACK.  
Failure to observe this caution may result in electric shock or injury.
- Do not attempt to change wiring while the power is ON.  
Failure to observe this caution may result in electric shock or injury.
- When replacing the SERVOPACK, resume operation only after copying the previous SERVOPACK parameters to the new SERVOPACK.  
Failure to observe this caution may result in damage to the product.

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## ■ Disposal

### CAUTION

- When disposing of the products, treat them as ordinary industrial waste.

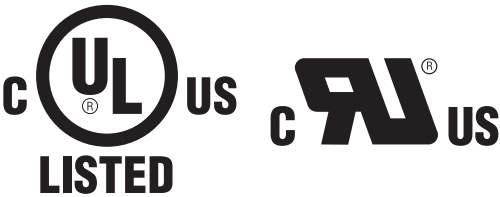
## ■ General Precautions

### Observe the following general precautions to ensure safe application.

- The products shown in illustrations in this manual are sometimes shown without covers or protective guards. Always replace the cover or protective guard as specified first, and then operate the products in accordance with the manual.
- The drawings presented in this manual are typical examples and may not match the product you received.
- This manual is subject to change due to product improvement, specification modification, and manual improvement. When this manual is revised, the manual code is updated and the new manual is published as a next edition. The edition number appears on the front and back covers.
- If the manual must be ordered due to loss or damage, inform your nearest Yaskawa representative or one of the offices listed on the back of this manual.
- Yaskawa will not take responsibility for the results of unauthorized modifications of this product.  
Yaskawa shall not be liable for any damages or troubles resulting from unauthorized modification.

# Applicable Standards

■ North American Safety Standards (UL)



	Model	UL * Standards (UL File No.)
SERVOPACK	• SGD V	UL508C (E147823)
Servomotor	• SGMJV • SGMAV • SGMPS • SGMGV • SGMSV	UL1004 (E165827)

\* Underwriters Laboratories Inc.

■ European Standards



	Model	Low Voltage Directive	EMC Directive		Safety Standards
			EMI	EMS	
SERVOPACK	• SGD V	EN50178 EN61800-5-1	EN55011/A2 group 1 class A EN61800-3	EN61800-3 EN61000-6-2	EN954-1 IEC61508-1 to 4
Servomotor	• SGMJV • SGMAV • SGMPS • SGMGV • SGMSV	IEC60034-1 IEC60034-5 IEC60034-8 IEC60034-9	EN55011/A2 group 1 class A EN61800-3	EN61800-3 EN61000-6-2	—

Note: Because SERVOPACKs and servomotors are built into machines, certification is required after installation in the user’s product.

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## Overview of Setup

This chapter describes how to set up the  $\Sigma$ -V series of servo drives.




This chapter describes the flow of the setup procedure from installation until a JOG operation. A panel operator, a digital operator, and SigmaWin+, (which is an engineering tool that can be used with a PC) are available to set up a servo drive. The panel operator is included with the SERVOPACK, and the digital operator and SigmaWin+ are sold separately.



CAUTION

- An alarm or warning may be generated if communications are executed with the host controller during operation using SigmaWin+ or the digital operator. If an alarm or warning is generated, the process currently being executed may be aborted and the system may stop.



Be sure to read 5.2 *Inspection and Checking before Trial Operation*.

IMPORTANT

Operation	Reference (in this manual)
Install the servomotor and SERVOPACK.	<i>Chapter 2 Installation</i>
↓	
Perform the required wiring and connections for a JOG operation.	<i>Chapter 3 Wiring and Connection</i>
↓	
Perform a JOG operation for the servomotor using <ul style="list-style-type: none"><li>• the panel operator</li><li>• the digital operator, or</li><li>• SigmaWin+</li></ul>	<i>Chapter 5 Trial Operation (Checking Servomotor Operation)</i> <ul style="list-style-type: none"><li>● Trial Operation Using the Panel Operator<ul style="list-style-type: none"><li>→ 5.3 JOG Operation Using a Panel Operator</li></ul></li><li>● Trial Operation Using the Digital Operator<ul style="list-style-type: none"><li>→ 5.4 JOG Operation Using a Digital Operator</li></ul></li><li>● Trial Operation Using SigmaWin+.<ul style="list-style-type: none"><li>→ 5.5 JOG Operation Using SigmaWin+</li></ul></li></ul>

## Installation

This chapter describes how to install the servomotor and the SERVOPACK.

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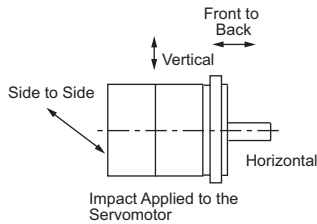
2.1 Installation Environment and Applicable Standards

The installation environment and the applicable standards for servomotors and SERVOPACKs are described in this section.

2.1.1 Servomotor Installation Environment

- Ambient temperature: 0 to 40°C
- Ambient humidity: 80% RH or less (with no condensation)
- Altitude: 1, 000 m or less
- Vibration resistance

The servomotor will withstand the following vibration acceleration in three directions: vertical, side to side, and front to back.



Servomotor Model	Vibration Acceleration at Flange
SGMJV, SGMV, SGMP, SGMCS-02 to -35	49 m/s <sup>2</sup>
SGMGV-03 to -44, SGMSV-10 to -55	49 m/s <sup>2</sup> (Front to back direction: 24.5m/s <sup>2</sup> )
SGMGV-55 to -1E, SGMCS-45 to -2Z	24.5 m/s <sup>2</sup>
SGMSV-70	14.7 m/s <sup>2</sup>

- Shock resistance: 490 m/s<sup>2</sup> at servomotor flange
- Installation site: An environment that satisfies the following conditions
  - Indoors and free of corrosive or explosive gases
  - Well-ventilated and free of dust and moisture
  - Facilitates inspection and cleaning
  - Free of high magnetic field

## 2.1.2 SERVOPACK Installation Environment

- Surrounding air temperature: 0 to 55°C
- Ambient humidity: 90% RH or less (with no condensation)
- Altitude: 1,000 m or less
- Vibration resistance: 4.9 m/s<sup>2</sup>
- Shock resistance: 19.6 m/s<sup>2</sup>
- Installation Precautions

- Mounting in a Control Panel

To prevent the temperature around the SERVOPACK from exceeding 55°C, take into account the size of the control panel, the layout of the SERVOPACK, and the cooling method. For details, refer to 2.3 *SERVOPACK Installation*.

- Mounting Near a Heating Unit

To prevent the temperature around the SERVOPACK from exceeding 55°C, suppress radiant heat from the heating unit and temperature rise due to convection.

- Mounting Near a Vibration Source

To prevent vibration from being transmitted to the SERVOPACK, install a vibration isolator underneath the SERVOPACK.

- Mounting to a Location Exposed to Corrosive Gas

Take measures to prevent exposure to corrosive gas. Corrosive gases will not immediately affect the SERVOPACK, but will eventually cause electronic components and contactor-related devices to malfunction.

- Other Locations

Do not mount the SERVOPACK in locations subject to high temperatures, high humidity, dripping water, cutting oil, dust, iron filings, or radiation.

<Note>

When storing the SERVOPACK with the power OFF, store it in an environment with the following temperature and humidity:

- -20 to +85°C, 90% RH or less. (with no condensation)

2.1.3 Installation Conditions for Applicable Standards

Applicable Standards	UL508C EN50178, EN55011/A2 group1 classA, EN61000-6-2, EN61800-3, EN61800-5-1, EN954-1, IEC61508-1 to 4
Operating Conditions	Overvoltage Category: III Pollution degree: 2 Protection class: IP10
Installation Conditions	UL Standard and Low Voltage Directive: Satisfy the conditions outlined in <i>Σ-V Series AC SERVOPACK SGD V Safety Precautions</i> (TOBP C710800 10) EMC Directive: Certification is required after installation in the user’s machine under the conditions outlined in <i>2.4 EMC Installation Conditions</i> of this manual.

## 2.2 Servomotor Installation

### 2.2.1 Orientation

Servomotors can be installed either horizontally or vertically.

Servomotors with gears can be installed only horizontally, depending on gear lubrication conditions. Refer to *Σ-V Series Product Catalog* (KAEP S800000 42) for details.

### 2.2.2 Installation Standards

The motor rated specifications (rated output, rated torque, and rated speed) are the continuous allowable values at an ambient temperature of 40°C when servomotors are installed with heat sinks.

For more information on heat sinks, refer to *Σ-V Series Product Catalog* (KAEP S800000 42).

When a motor is mounted on a small surface, the motor temperature may rise considerably because of the limited heat radiating abilities of the surface. To restrict the temperature rise, you should either mount a heat sink or limit the electrical, thermal, and mechanical stress on the motor (derating). Refer to *Σ-V Series Product Catalog* (KAEP S800000 42) for the relation between heat sink size and derating. The data in the catalog is given only for reference, as the actual temperature rise depends on how the heat sink (motor mounting section) is fixed on the installation surface and what material is used for the motor mounting section. Always check the actual motor temperature.

If the servomotor is covered, or if a heating element is installed near the servomotor, the motor temperature may rise considerably. In this case, take following counter-measures.

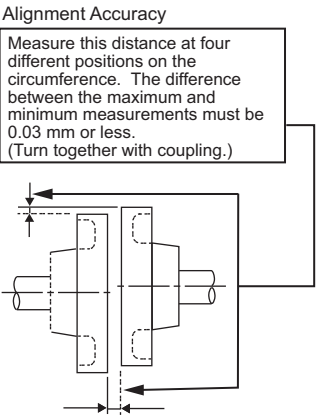
- Reduce the load ratio.
- Reconsider the motor heating conditions.
- Install a cooling fan to forcedly cool the motor.

2.2.3 Connecting Servomotor to Machine

The end of the motor shaft is coated with anticorrosive paint. Thoroughly remove the paint prior to installation.

Align the shaft of the servomotor with the shaft of the machine, and then couple the shafts. Install the servomotor so that alignment accuracy falls within the following range. Vibration will damage the bearings or encoders if the shafts are not properly aligned.

Do not allow direct impact to be applied to the shafts when installing the coupling as the encoder mounted on the opposite end of the shaft may be damaged.



### 2.2.4 Protective Structure

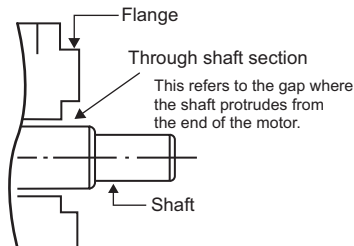
The servomotor protective structure\* is described below.

Model	Without Gears	With Gears
SGMJV, SGMAV	IP65	IP55
SGMPS	IP55 IP67 (Optional)	IP55
SGMGV	IP67	—
SGMSV	IP67 (SGMSV-70 servomotor only: IP22)	—
SGMCS-02 to -35	IP42 (expect for gaps on the rotating section of the shaft)	—
SGMCS-45 to -ZZ	IP44	—

\* Except through shaft section. The protective structure specifications can be satisfied only when using a specified cable.

When the through shaft section is subject to oil exposure, refer to 2.2.5 *Other Precautions*.

For SGMJV and SGMAV servomotors, the protective structure specifications can be satisfied only when using a specified cable.





## 2.2.5 Other Precautions

### ■ Handling Oil and Water

If the servomotor is used in a location that is subject to water or oil mist, use a servomotor with an oil seal to seal the through shaft section. Precautions on using a servomotor with an oil seal are described below.

- Put the oil surface under the oil seal lip.
- Use an oil seal in favorably lubricated condition.
- When using a servomotor with its shaft upward direction, be sure that oil will not stay in the oil seal lips.

### ■ Cable Stress

Make sure there are no bends or tension on the motor main circuit cables and encoder cables.

Be especially careful to wire encoder cables so that they are not subject to stress because the core wires are very thin at only 0.2 or 0.3 mm<sup>2</sup>.

### ■ Connectors

Observe the following precautions:

- Make sure there is no foreign matters such as dust and metal chips in the connector before connecting.
- When the connectors are connected to the motor, be sure to connect the end of motor main circuit cables before connecting the encoder cable's end.  
If the encoder cable's end is connected, the encoder may break because of the voltage differences between FG.
- Make sure of the pin arrangement.
- Do not apply shock to resin connectors. Otherwise, they may be damaged.
- When handling a servomotor with its cables connected, hold the servomotor or the connectors and cables will be damaged.
- Fix the connector to SGMJV, SGMAV, SGMPS-01/-02/-04 or SGMGV-03/-05 servomotors with screws. Make sure that the connector is securely fixed with screws.  
If not, the protective construction specifications may not be satisfied.
- Be sure not to apply stress on the connector. The connector may be damaged by stress.

### ■ Radial and Thrust loads

Design the mechanical system so thrust and radial loads applied to the servomotor shaft end during operation fall within the allowable ranges of each motor. Refer to *Σ-V Series Product Catalog* (KAEP S800000 42) for the allowable ranges.

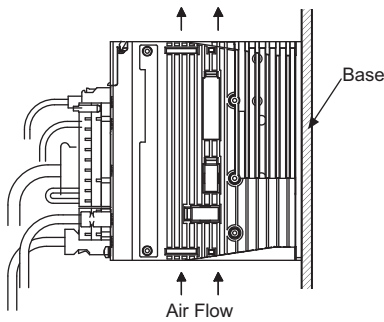
## 2.3 SERVOPACK Installation

### 2.3.1 Orientation

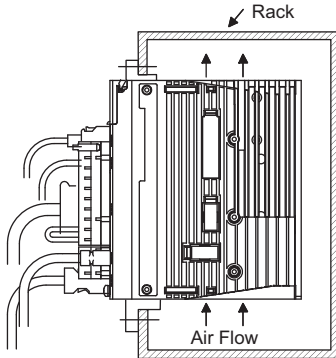
The SERVOPACK is available in models that are base-mounted, models that are rack-mounted, and models that are duct-ventilated. In any case, mount the SERVOPACK with a vertical orientation.

Firmly secure the SERVOPACK to the mounting surface, using either two or four mounting holes depending on the SERVOPACK capacity.

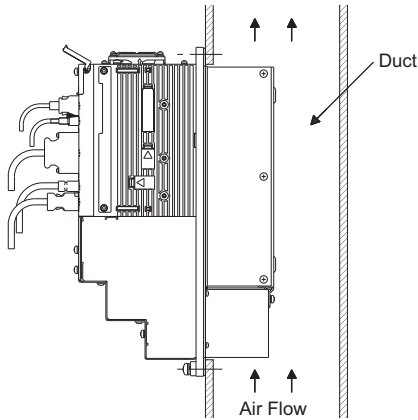
- Base-mounted



- Rack-mounted



- Duct-ventilated



### 2.3.2 Installation Standards

Observe the standards for mounting SERVOPACKs in control panels, including those for the mounting SERVOPACKs side by side in one control panel as shown in the following illustration.

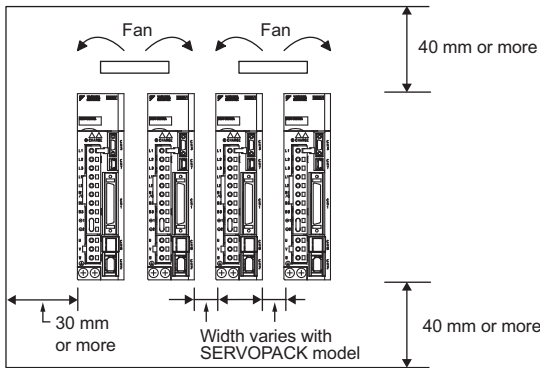
- SERVOPACK Mounting Orientation

Mount the SERVOPACK vertically to the wall, with the front panel (the side with the panel operator display) facing out.

- Cooling

Refer to the following diagram and leave sufficient space for cooling by fans and natural convection.

- Mounting SERVOPACKs Side by Side in a Control Panel



Leave sufficient space on each side and at the top and the bottom of each SERVOPACK. The width on each side varies in accordance with the models of the SERVOPACKs used.

SERVOPACK Model SGDV-	Side		Top and bottom
	Left	Right	
R70F, R90F, 2R1F, R70A, R90A, 1R6A, 2R8A	1 mm or more		40 mm or more
2R8F, 3R8A, 5R5A, 7R6A	1 mm or more	10 mm or more	
120A, 180A, 200A, 330A, 470A, 550A, 590A, 780A, 1R9D, 3R5D, 5R4D, 8R4D, 120D, 170D, 210D, 260D, 280D, 370D	10 mm or more		

Also install cooling fans above the SERVOPACKs to disperse local pockets of warmer air around the SERVOPACKs.

- Inside the Control Panel

The conditions inside the control panel should be the same as the environmental conditions of the SERVOPACK. Refer to 2.1.2 *SERVOPACK Installation Environment*.

2.4 EMC Installation Conditions

This section describes the recommended installation conditions that satisfy EMC guidelines for each model of the SGD<sub>V</sub> SERVOPACK. The conditions required for the standard type (base-mounted) of SERVOPACK are described. Refer to this section for other SERVOPACK models such as the rack-mounted types as well.

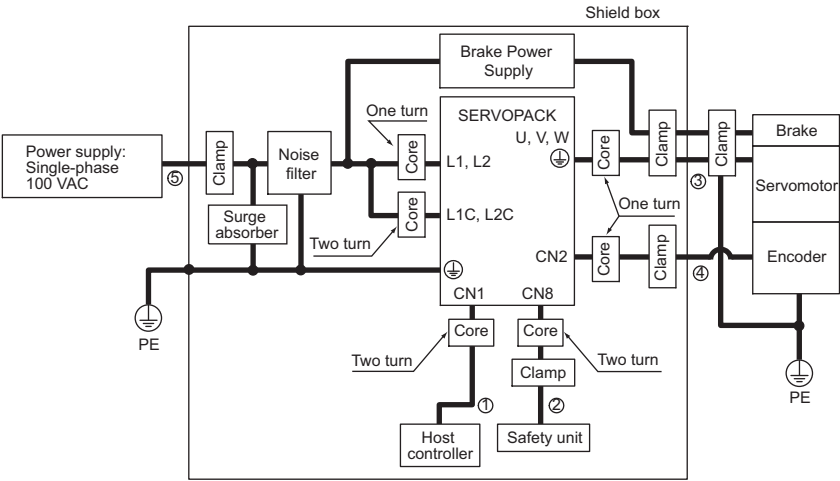
This section describes the EMC installation conditions satisfied in test conditions prepared by Yaskawa. The actual EMC level may differ depending on the actual system’s configuration, wiring, and other conditions. However, because this product is built-in, check that the following conditions are still met after being installed in the user’s product.

The applicable standards are EN55011/A2 group 1 class A, EN61800-3, and EN61000-6-2.

■ SGD<sub>V</sub>-□□□□01A (Analog pulse model)

- Single-phase 100 V

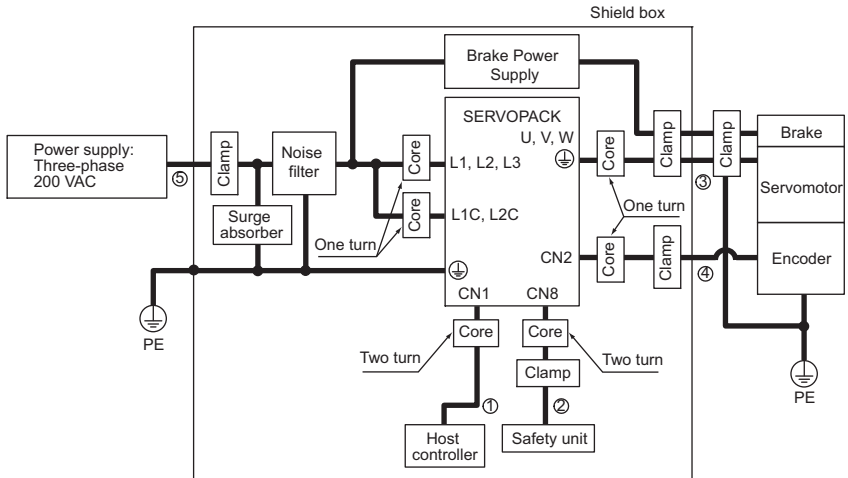
SGD<sub>V</sub>-□□□F01A (□□□ = R70, R90, 2R1, 2R8)



Symbol	Cable Name	Specification
①	I/O signal cable	Shield cable
②	Safety signal cable	Shield cable
③	Motor main circuit cable	Shield cable
④	Encoder cable	Shield cable
⑤	Main circuit cable	Shield cable

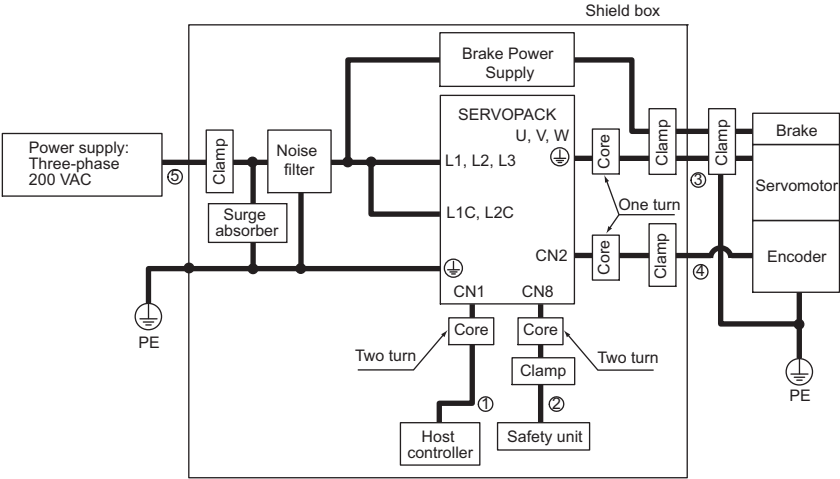
- Three-phase 200 V

SGDV-□□□A01A (□□□ = R70, R90, 1R6, 2R8, 3R8, 5R5, 7R6)



Symbol	Cable Name	Specification
①	I/O signal cable	Shield cable
②	Safety signal cable	Shield cable
③	Motor main circuit cable	Shield cable
④	Encoder cable	Shield cable
⑤	Main circuit cable	Shield cable

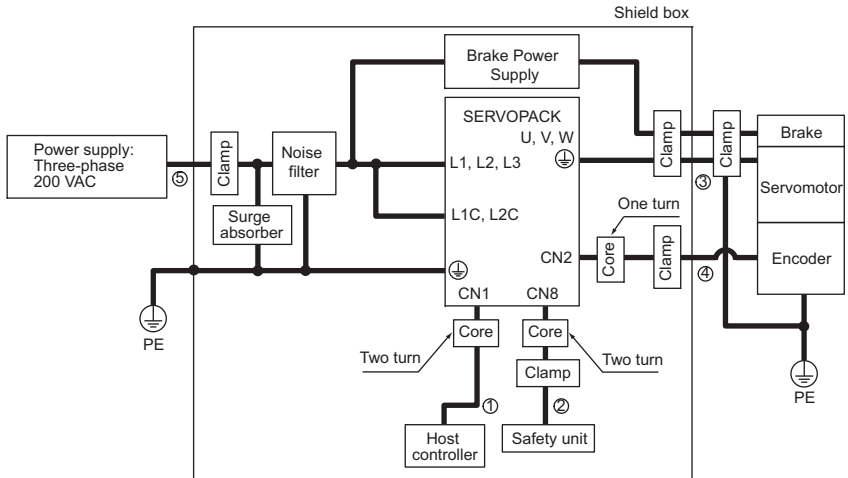
- Three-phase 200 V  
SGDV-□□□A01A (□□□ = 120)



Symbol	Cable Name	Specification
①	I/O signal cable	Shield cable
②	Safety signal cable	Shield cable
③	Motor main circuit cable	Shield cable
④	Encoder cable	Shield cable
⑤	Main circuit cable	Shield cable

- Three-phase 200 V

SGDV-□□□A01A (□□□ = 180, 200, 330)

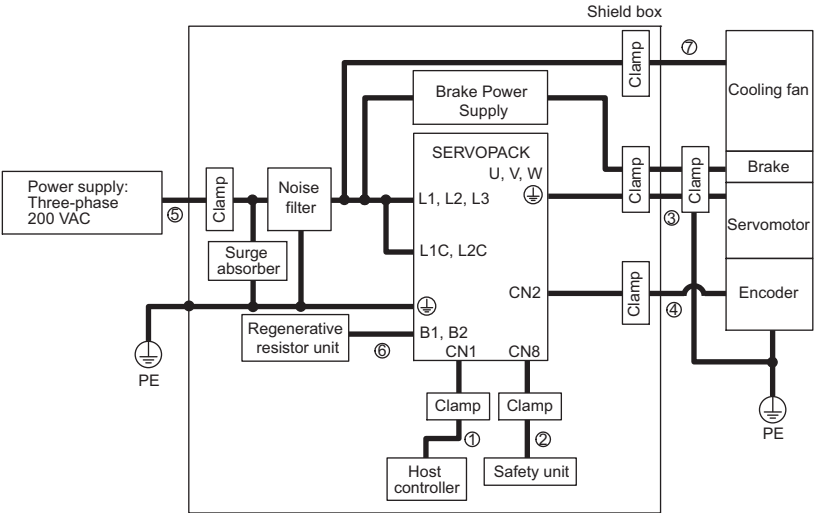


Symbol	Cable Name	Specification
①	I/O signal cable	Shield cable
②	Safety signal cable	Shield cable
③	Motor main circuit cable	Shield cable
④	Encoder cable	Shield cable
⑤	Main circuit cable	Shield cable



• Three-phase 200 V

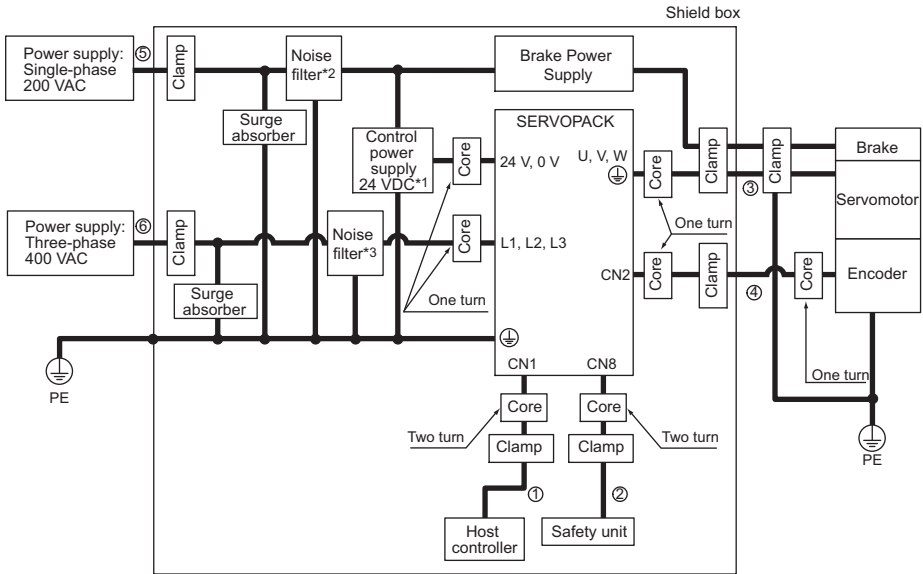
SGDV-□□□A01A (□□□ = 470, 550, 590, 780)



Symbol	Cable Name	Specification
①	I/O signal cable	Shield cable
②	Safety signal cable	Shield cable
③	Motor main circuit cable	Shield cable
④	Encoder cable	Shield cable
⑤	Main circuit cable	Shield cable
⑥	Regenerative resistor unit cable	Non-shield cable
⑦	Cooling fan cable	Shield cable

• Three-phase 400 V

SGDV-□□□□D01A (□□□ = 1R9, 3R5, 5R4, 8R4, 120, 170)

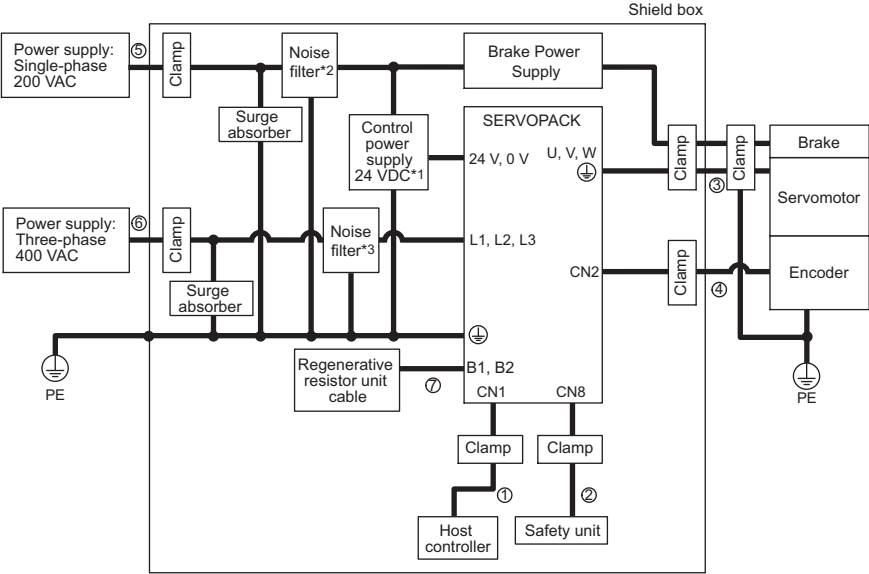


Symbol	Cable Name	Specification
①	I/O signal cable	Shield cable
②	Safety signal cable	Shield cable
③	Motor main circuit cable	Shield cable
④	Encoder cable	Shield cable
⑤	Control power cable	Shield cable
⑥	Main circuit cable	Shield cable

- \*1. Products that have received CE marking are recommended for the 24 VDC power supply.
- \*2. Install the following noise filter on the power line between the single-phase 200 V power supply and the 24 VDC power supply.  
Model number: FN2070-6/07 (SCHAFFNER)
- \*3. For more information on this filter, refer to *Σ-V Series Product Catalog*. (KAEP S800000 42)

• Three-phase 400 V

SGDV-□□□□D01A (□□□ = 210, 260, 280, 370)



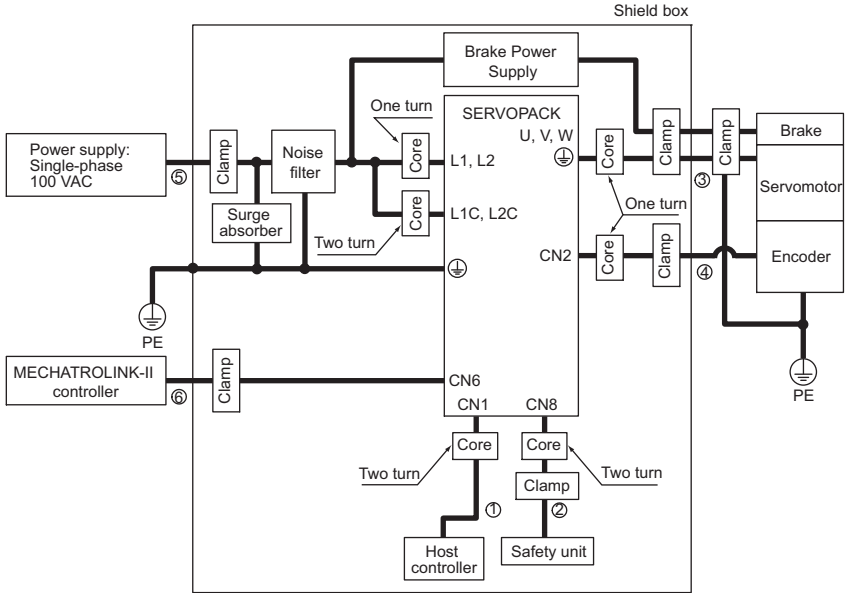
Symbol	Cable Name	Specification
①	I/O signal cable	Shield cable
②	Safety signal cable	Shield cable
③	Motor main circuit cable	Shield cable
④	Encoder cable	Shield cable
⑤	Control power cable	Shield cable
⑥	Main circuit cable	Shield cable
⑦	Regenerative resistor unit cable	Non-shield cable

- \*1. Products that have received CE marking are recommended for the 24 VDC power supply.
- \*2. Install the following noise filter on the power line between the single-phase 200 V power supply and the 24 VDC power supply.  
Model number: FN2070-6/07 (SCHAFFNER)
- \*3. For more information on this filter, refer to *Σ-V Series Product Catalog*. (KAEP S800000 42)

# ■ SGDV-□□□□11A (M-II model)

- Single-phase 100 V

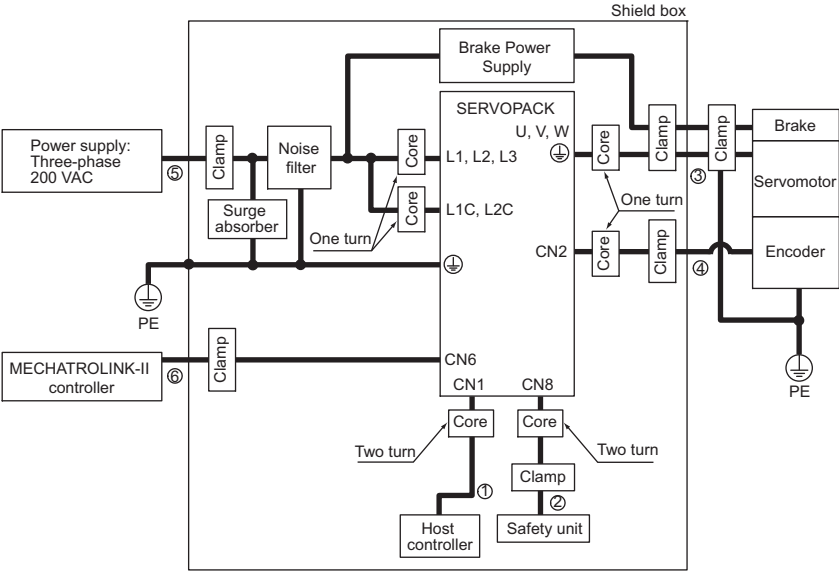
SGDV-□□□F11A (□□□ = R70, R90, 2R1, 2R8)



Symbol	Cable Name	Specification
①	I/O signal cable	Shield cable
②	Safety signal cable	Shield cable
③	Motor main circuit cable	Shield cable
④	Encoder cable	Shield cable
⑤	Main circuit cable	Shield cable
⑥	MECHATROLINK-II communication cable	Shield cable

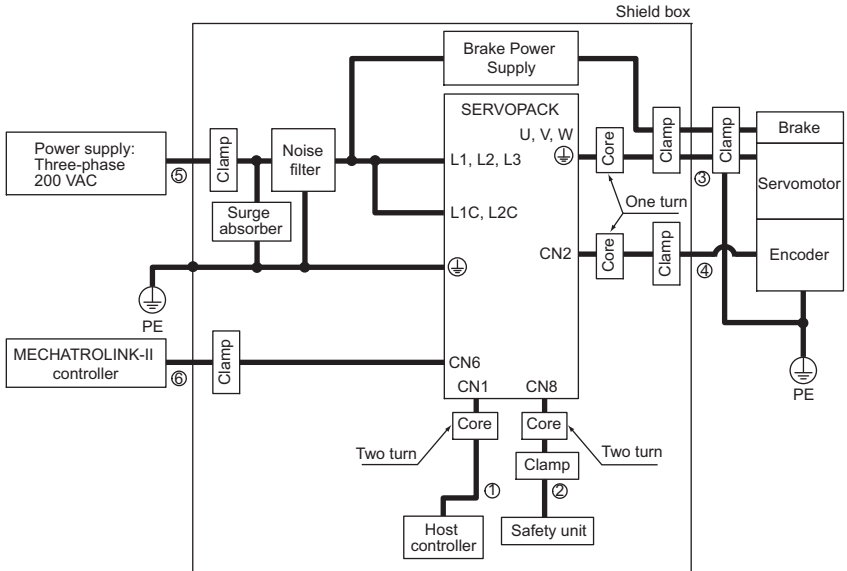
- Three-phase 200 V

SGDV-□□□A11A (□□□ = R70, R90, 1R6, 2R8, 3R8, 5R5, 7R6)



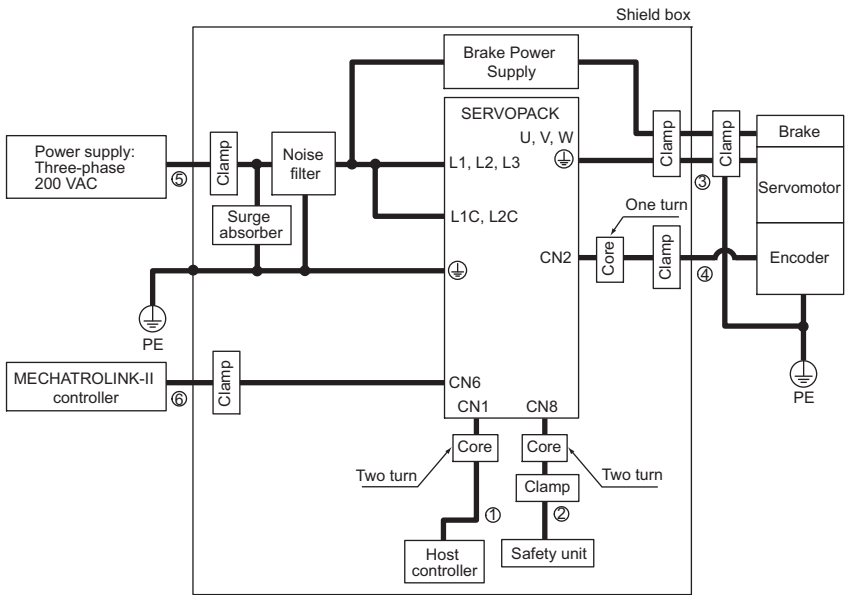
Symbol	Cable Name	Specification
①	I/O signal cable	Shield cable
②	Safety signal cable	Shield cable
③	Motor main circuit cable	Shield cable
④	Encoder cable	Shield cable
⑤	Main circuit cable	Shield cable
⑥	MECHATROLINK-II communication cable	Shield cable

- Three-phase 200 V  
SGDV-□□□A11A (□□□ = 120)



Symbol	Cable Name	Specification
①	I/O signal cable	Shield cable
②	Safety signal cable	Shield cable
③	Motor main circuit cable	Shield cable
④	Encoder cable	Shield cable
⑤	Main circuit cable	Shield cable
⑥	MECHATROLINK-II communication cable	Shield cable

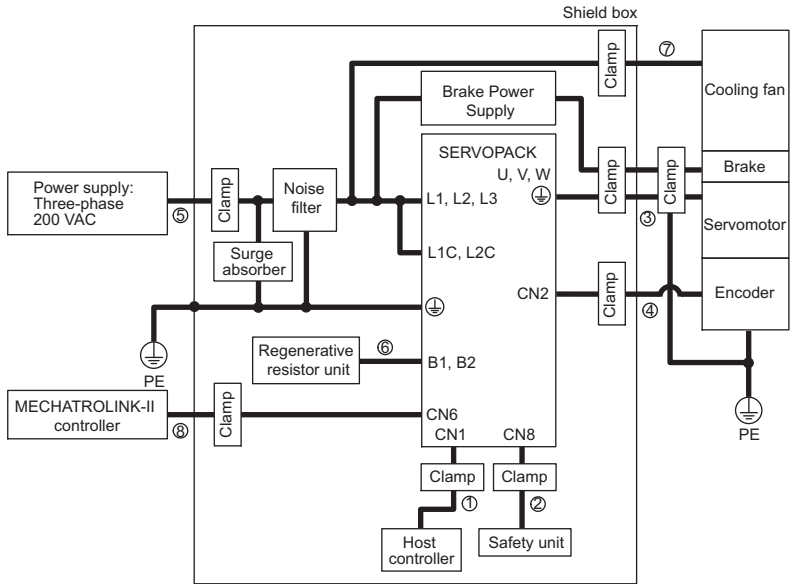
- Three-phase 200 V  
SGDV-□□□A11A (□□□ = 180, 200, 330)



Symbol	Cable Name	Specification
①	I/O signal cable	Shield cable
②	Safety signal cable	Shield cable
③	Motor main circuit cable	Shield cable
④	Encoder cable	Shield cable
⑤	Main circuit cable	Shield cable
⑥	MECHATROLINK-II communication cable	Shield cable

- Three-phase 200 V

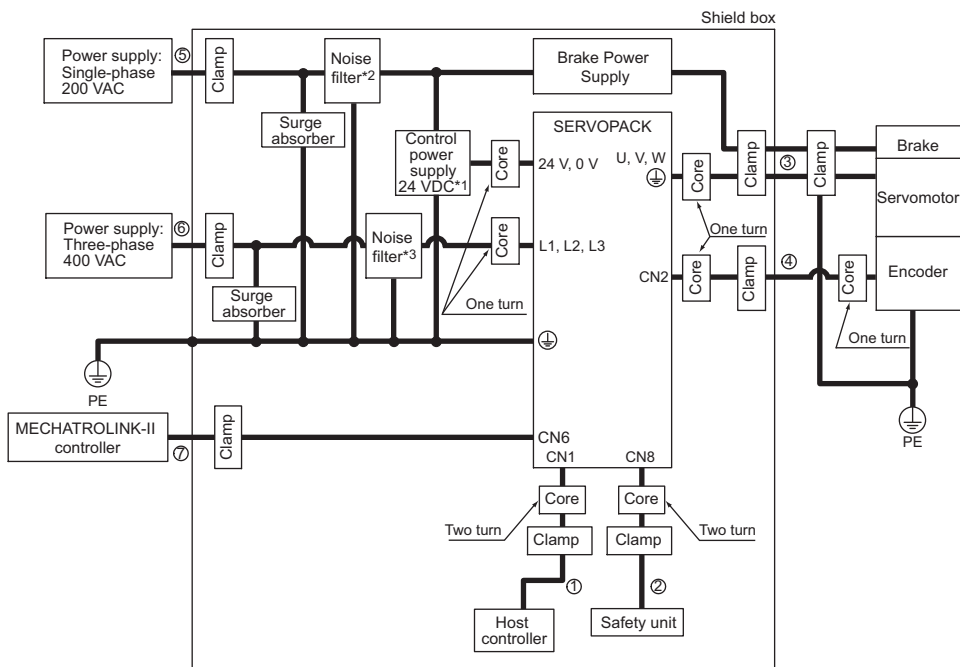
SGDV-□□□A11A (□□□ = 470, 550, 590, 780)



Symbol	Cable Name	Specification
①	I/O signal cable	Shield cable
②	Safety signal cable	Shield cable
③	Motor main circuit cable	Shield cable
④	Encoder cable	Shield cable
⑤	Main circuit cable	Shield cable
⑥	Regenerative resistor unit cable	Non-shield cable
⑦	Cooling fan cable	Shield cable
⑧	MECHATROLINK-II communication cable	Shield cable



- Three-phase 400 V  
SGDV-□□□D11A (□□□ = 1R9, 3R5, 5R4, 8R4, 120, 170)

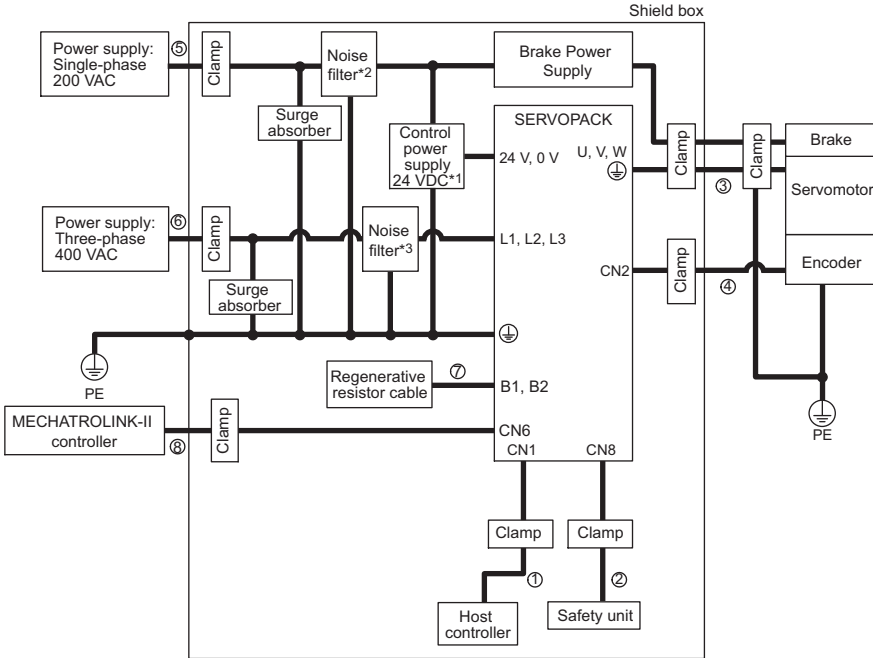


Symbol	Cable Name	Specification
①	I/O signal cable	Shield cable
②	Safety signal cable	Shield cable
③	Motor main circuit cable	Shield cable
④	Encoder cable	Shield cable
⑤	Control power cable	Shield cable
⑥	Main circuit cable	Shield cable
⑦	MECHATROLINK-II communication cable	Shield cable

- \*1. Products that have received CE marking are recommended for the 24 VDC power supply.
- \*2. Install the following noise filter on the power line between the single-phase 200 V power supply and the 24 VDC power supply.  
Model number: FN2070-6/07 (SCHAFFNER)
- \*3. For more information on this filter, refer to *Σ-V Series Product Catalog*. (KAEP S800000 42)

- Three-phase 400 V

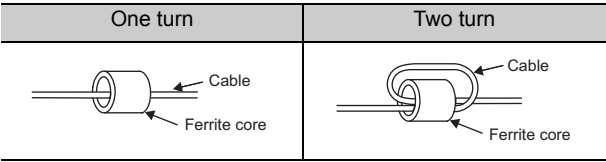
SGDV-□□□□D11A (□□□ = 210, 260, 280, 370)



Symbol	Cable Name	Specification
①	I/O signal cable	Shield cable
②	Safety signal cable	Shield cable
③	Motor main circuit cable	Shield cable
④	Encoder cable	Shield cable
⑤	Control power cable	Shield cable
⑥	Main circuit cable	Shield cable
⑦	Regenerative resistor unit cable	Non-shield cable
⑧	MECHATROLINK-II communication cable	Shield cable

- \*1. Products that have received CE marking are recommended for the 24 VDC power supply.
- \*2. Install the following noise filter on the power line between the single-phase 200 V power supply and the 24 VDC power supply.  
Model number: FN2070-6/07 (SCHAFFNER)
- \*3. For more information on this filter, refer to *Σ-V Series Product Catalog*. (KAEP S800000 42)

■ Attachment Methods of Ferrite Cores



■ Recommended Ferrite Core

Cable Name	Ferrite Core Model	Manufacturer
Motor main circuit cable	ESD-SR-250	NEC TOKIN Corp.

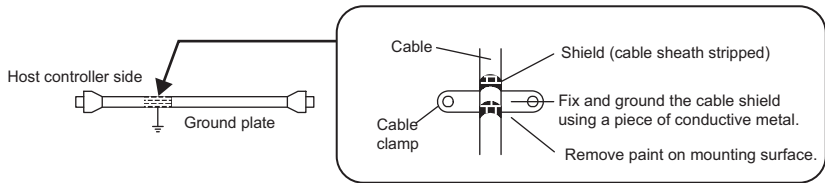
■ Recommended Noise Filter and Surge Absorber

For more information on recommended noise filters and surge absorbers, refer to *Σ-V Series Product Catalog*. (KAEP S800000 42)

■ Fixing the Cable

Fix and ground the cable shield using a piece of conductive metal.

- Example of Cable Clamp



■ Shield Box

A shield box, which is a closed metallic enclosure, is effective as reinforced shielding against electromagnetic interference (EMI) from SERVOPACKs. The structure of the box should allow the main body, door, and cooling unit to be attached to the ground. The box opening should be as small as possible.

<Note>

Do not connect the digital operator and the analog monitor cable to the SERVOPACK during operations. Connect them only when the machinery is stopped during maintenance.

## Wiring and Connection

This chapter describes how to set up the wiring and connections required for trial operation.

For more information on the wiring and connection, refer to the following manuals.

- $\Sigma$ -V Series User's Manual Design and Maintenance Rotational Motor/Analog Voltage and Pulse Train Reference (SIEP S800000 45)
- $\Sigma$ -V Series User's Manual Design and Maintenance Rotational Motor/ MECHATROLINK-II Communications Reference (SIEP S800000 46)

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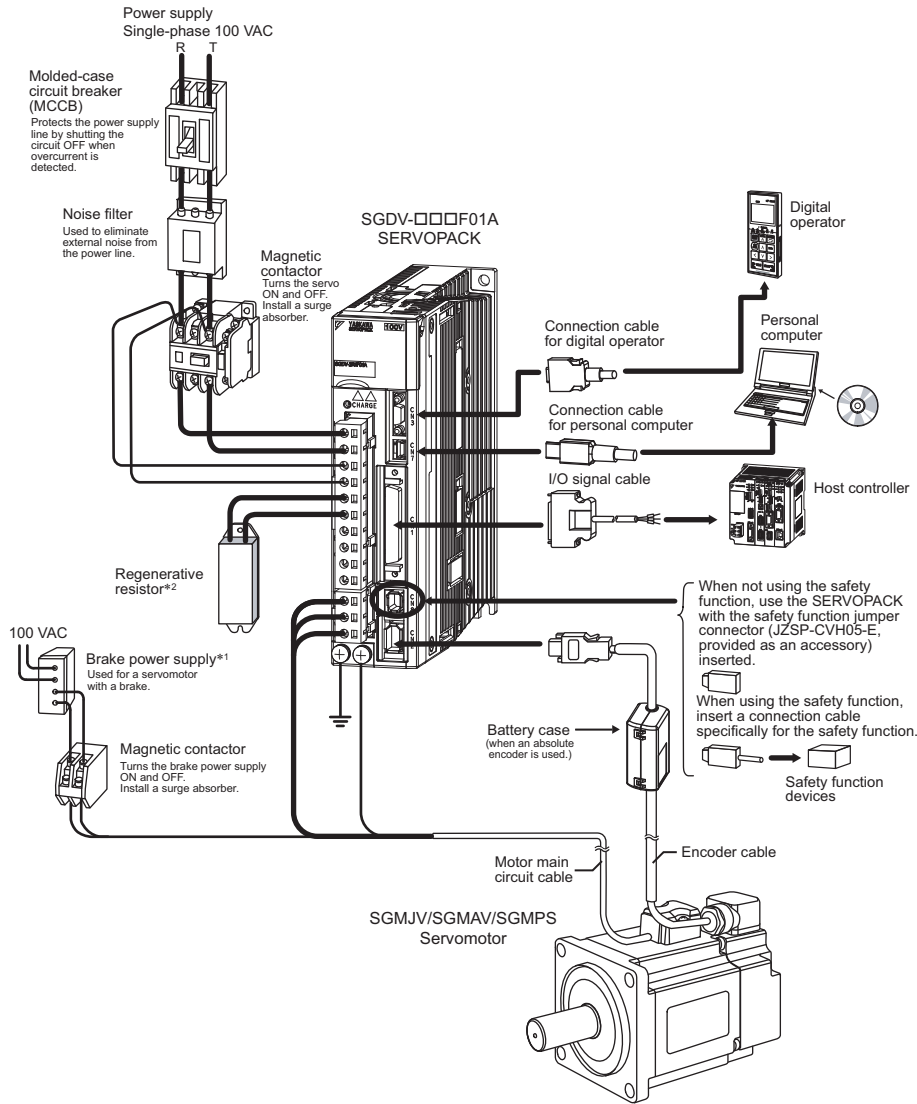
## 3.1 Precautions for Wiring

### CAUTION

- Be sure to wire correctly and securely.  
Failure to observe this caution may result in motor overrun, injury, or malfunction.
- Do not bundle or run the main circuit cables together with the I/O signal cables or the encoder cables in the same duct. Keep them separated by at least 30 cm.  
Failure to do so may result in malfunction.
- Use shielded twisted-pair wires or multi-core shielded twisted-pair wires for I/O signal cables and the encoder cables.
- I/O signal cables must be no longer than 3 m, encoder cables must be no longer than 50 m, and control power supply (+24 V, 0 V) cables for a 400 V input SERVOPACK must be no longer than 10 m.
- Do not touch the power terminals while the CHARGE lamp is ON after turning power OFF because high voltage may still remain in the SERVOPACK.  
Make sure the charge indicator is off first before starting an inspection.

### 3.2 System Configuration Diagram

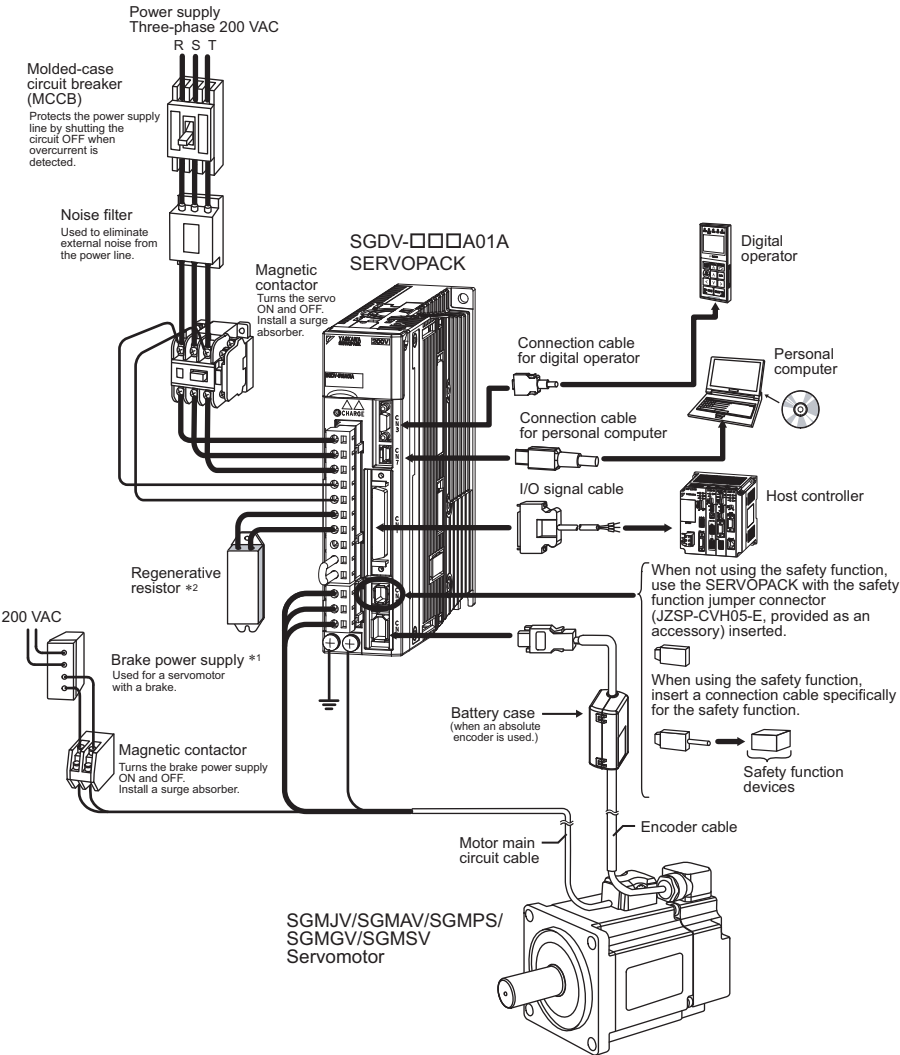
#### 3.2.1 Connecting to SGD□□□F01A SERVOPACK



\*1. Use a 24 VDC power supply. (not included)  
\*2. Before connecting an external regenerative resistor to the SERVOPACK, refer to 3.4 Connecting Regenerative Resistors.

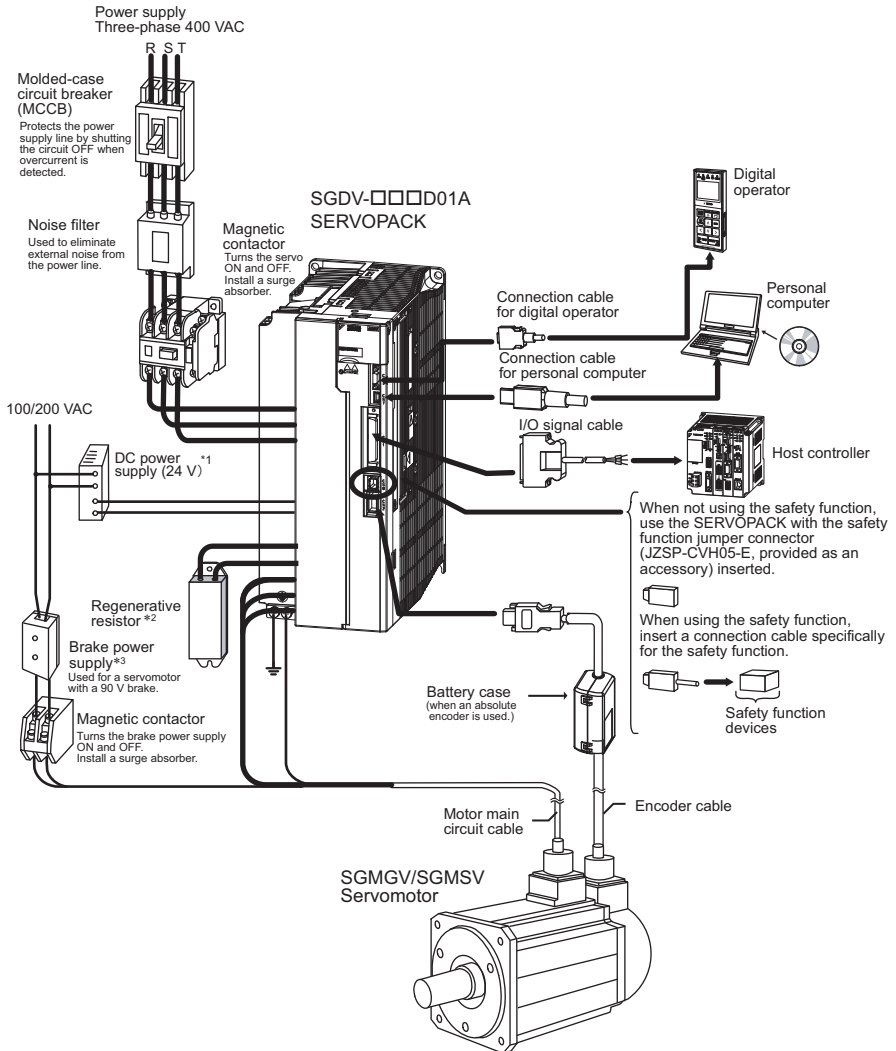
3.2.2 Connecting to SGDV-□□□A01A SERVOPACK

3.2.2 Connecting to SGDV-□□□A01A SERVOPACK



- \*1. Use a 24 VDC power supply. (not included)
- \*2. Before connecting an external regenerative resistor to the SERVOPACK, refer to 3.4 Connecting Regenerative Resistors.

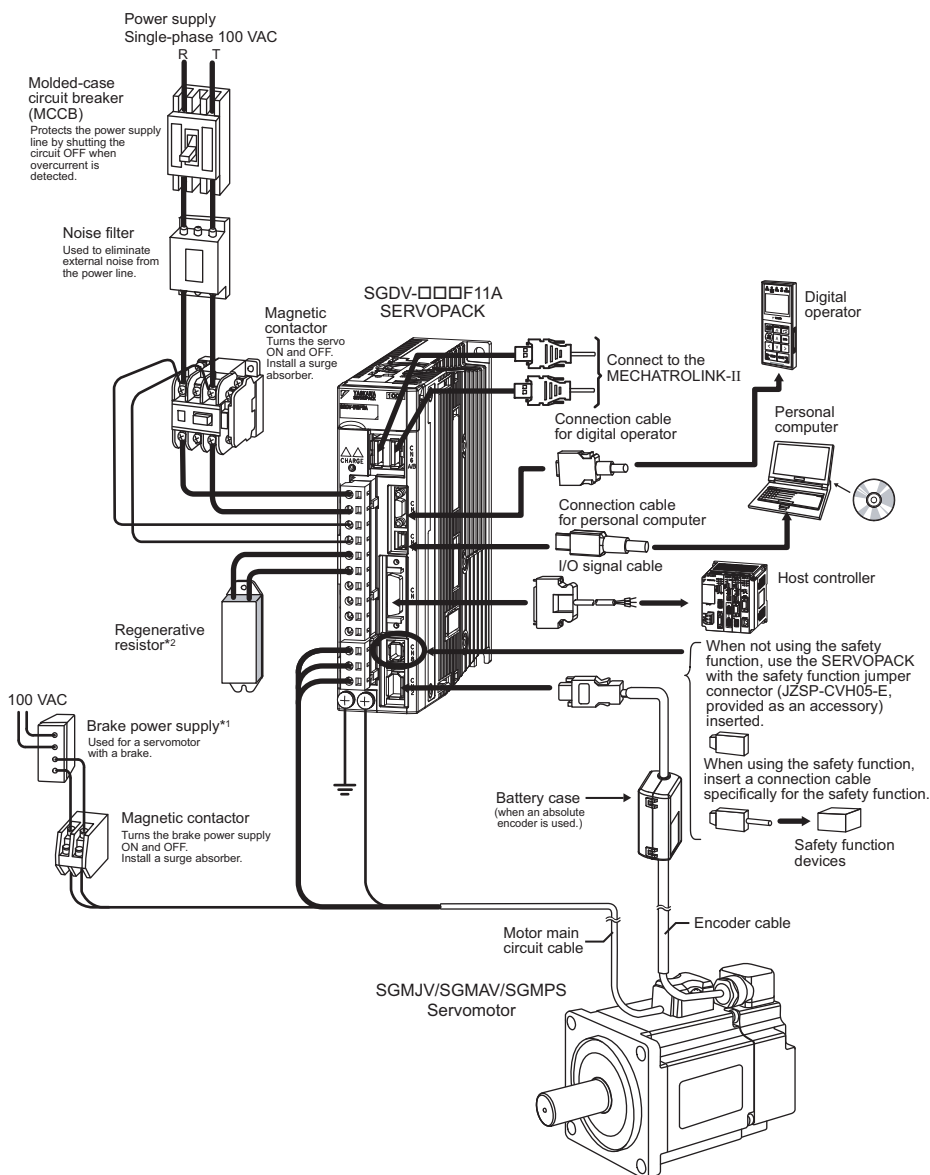
### 3.2.3 Connecting to SGDV-□□□D01A SERVOPACK



- \*1. Use a 24 VDC power supply with double insulation or reinforced insulation. (The power supply is not included)
- \*2. Before connecting an external regenerative resistor to the SERVOPACK, refer to 3.4 *Connecting Regenerative Resistors*.
- \*3. Use a following power supply for 90 V brake. For details, refer to *Σ-V series Product Catalog* (KAEP S800000 42).
  - For 200 V input voltage: LPSE-2H01-E
  - For 100 V input voltage: LPDE-1H01-E



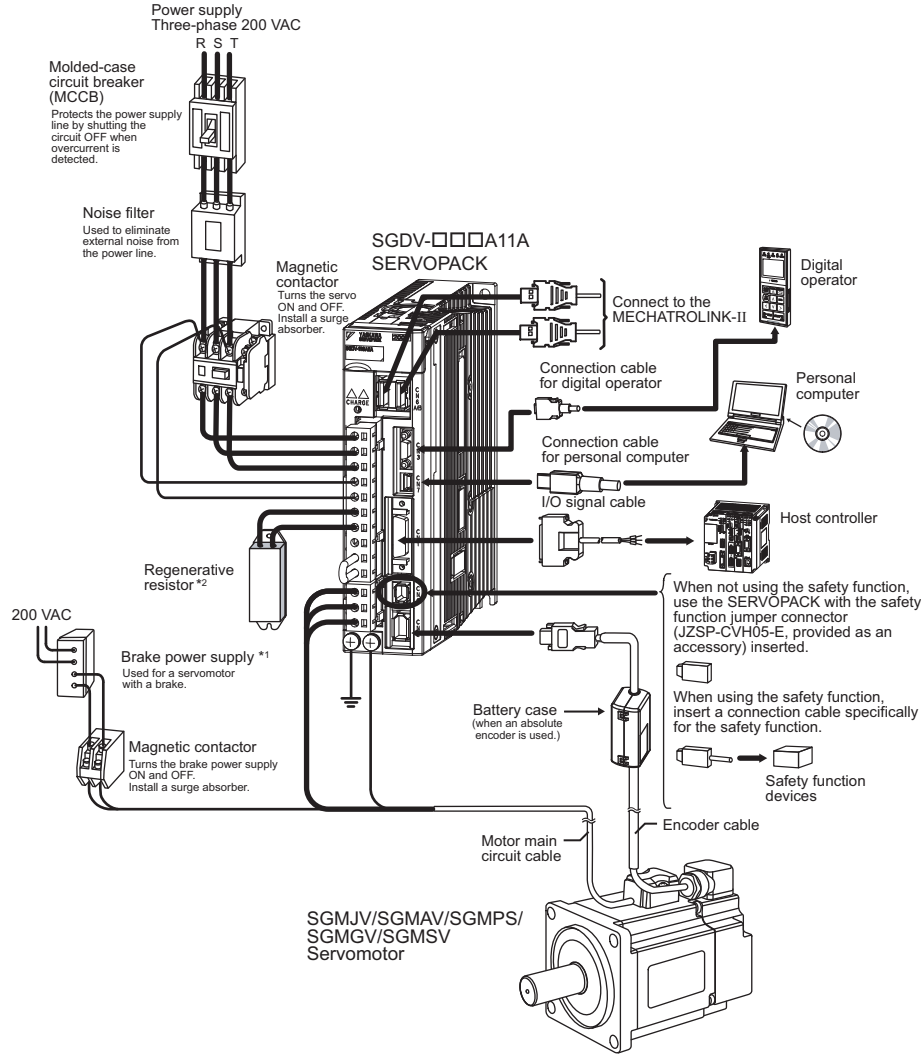
### 3.2.4 Connecting to SGDV-□□□F11A SERVOPACK



\*1. Use a 24 VDC power supply. (not included.)

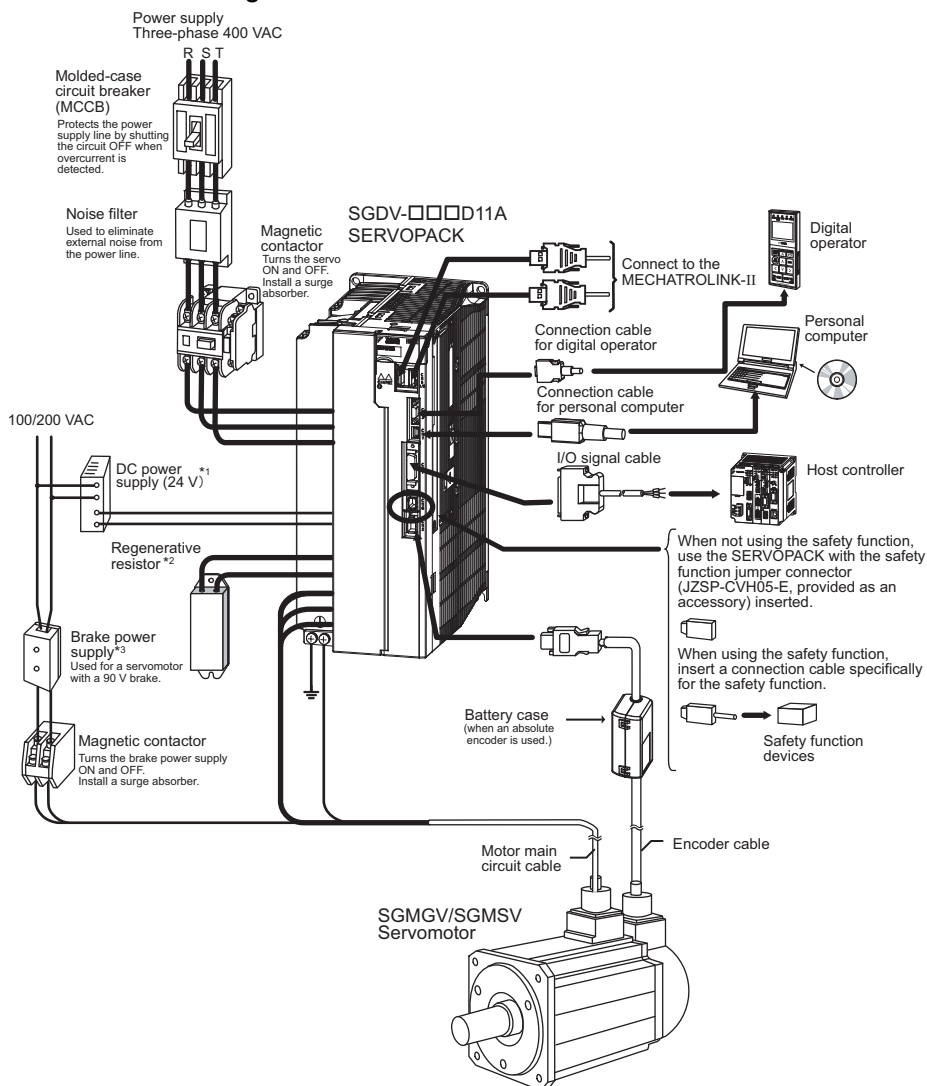
\*2. Before connecting an external regenerative resistor to the SERVOPACK, refer to 3.4 *Connecting Regenerative Resistors*.

### 3.2.5 Connecting to SGDV-□□□A11A SERVOPACK



- \*1. Use a 24 VDC power supply. (not included.)
- \*2. Before connecting an external regenerative resistor to the SERVOPACK, refer to 3.4 *Connecting Regenerative Resistors*.

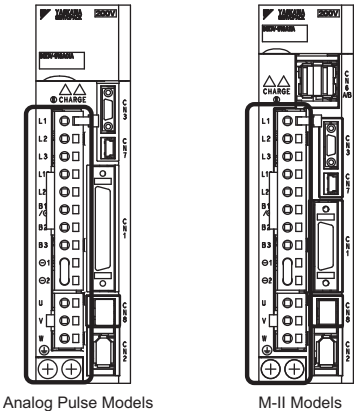
### 3.2.6 Connecting to SGDV-□□□D11A SERVOPACK



3.3 Main Circuit Wiring

The names, specifications, and functions of the main circuit terminals required for trial operation are given below.


3.3.1 Names and Functions of Main Circuit Terminals



Name	Terminal Symbols	Model SGDV-□□□□	Description
Main circuit input terminals	L1, L2	□□□F	Single-phase 100 to 115 V, +10% to -15% (50/60 Hz)
	L1, L2, L3	□□□A	Three-phase 200 to 230 V, +10% to -15% (50/60 Hz)
		□□□D	Three-phase 380 to 480 V, +10% to -15% (50/60 Hz)
Control power input terminals	L1C, L2C	□□□F	Single-phase 100 to 115 V, +10% to -15% (50/60 Hz)
		□□□A	Single-phase 200 to 230 V, +10% to -15% (50/60 Hz)
	24V, 0V	□□□D	24 VDC, ±15%


3.3.2 SERVOPACK Main Circuit Wire Size

(cont'd)

Name	Terminal Symbols	Model SGDV-□□□□	Description
External regenerative resistor terminals	B1/⊕, B2, or B1, B2	R70F, R90F, 2R1F, 2R8F, R70A, R90A, 1R6A, 2R8A	If the regenerative capacity is insufficient, connect an external regenerative resistor (option) between B1/⊕ and B2.
		3R8A, 5R5A, 7R6A, 120A, 180A, 200A, 330A, 1R9D, 3R5D, 5R4D, 8R4D, 120D, 170D	If the internal regenerative resistor is insufficient, remove the wire between B2 and B3 and connect an external regenerative resistor (option) between B1/⊕ and B2, or B1 and B2.
		470A, 550A, 590A, 780A, 210D, 260D, 280D, 370D	Connect a regenerative resistor unit (option) between B1/⊕ and B2, or B1 and B2.
DC reactor connection terminals for power supply harmonic suppression	⊖ 1, ⊖ 2	□□□A □□□D	Normally short ⊖ 1 and ⊖ 2. If a countermeasure against power supply harmonic waves is needed, connect a DC reactor between ⊖ 1 and ⊖ 2.
Main circuit plus terminals	B1/⊕ or B1	□□□A □□□D	Use when DC power supply input is used.
Main circuit minus terminals	⊖ 2 or ⊖	□□□A □□□D	
Servomotor connection terminals	U, V, W	Use for connecting to the servomotor.	
Ground terminals (× 2)		Use for connecting the power supply ground terminal and servomotor ground terminal.	

3.3.2 SERVOPACK Main Circuit Wire Size

This section describes the SERVOPACK Main Circuit Wire Size.



IMPORTANT

1. Wire sizes are selected for three cables per bundle at 40°C surrounding air temperature with the rated current.
2. Use a wire with a minimum withstand voltage of 600 V for the main circuit.
3. If cables are bundled in PVC or metal ducts, take into account the reduction of the allowable current.
4. Use a heat-resistant wire under high surrounding air or panel temperatures, where polyvinyl chloride insulated wires will rapidly deteriorate.

■ Wire Types

Use the following type of wire for main circuit.

Cable Type		Allowable Conductor Temperature °C
Symbol	Name	
IV	600 V polyvinyl chloride insulated wire	60
HIV	600 V grade heat-resistant polyvinyl chloride insulated wire	75

The following table shows the wire sizes and allowable currents for three wires. Use wires with specifications equal to or less than those shown in the table.

- 600 V grade heat-resistant polyvinyl chloride insulated wire (HIV)

AWG Size	Nominal Cross Section Diameter (mm <sup>2</sup> )	Configuration (Number of Wires/mm <sup>2</sup> )	Conductive Resistance (Ω/km)	Allowable Current at Surrounding Air Temperature (A)		
				30°C	40°C	50°C
20	0.5	19/0.18	39.5	6.6	5.6	4.5
19	0.75	30/0.18	26.0	8.8	7.0	5.5
18	0.9	37/0.18	24.4	9.0	7.7	6.0
16	1.25	50/0.18	15.6	12.0	11.0	8.5
14	2.0	7/0.6	9.53	23	20	16
12	3.5	7/0.8	5.41	33	29	24
10	5.5	7/1.0	3.47	43	38	31
8	8.0	7/1.2	2.41	55	49	40
6	14.0	7/1.6	1.35	79	70	57
4	22.0	7/2.0	0.85	91	81	66

Note: The values in the table are for reference only.

3.3.2 SERVOPACK Main Circuit Wire Size


■ Single-phase, 100 V

External Terminal Name	Terminal Symbols	SERVOPACK Model SGD V-			
		R70	R90	2R1	2R8
Main circuit power input terminals	L1, L2	HIV1.25		HIV2.0	
Control power input terminals	L1C, L2C	HIV1.25			
Servomotor connection terminals	U, V, W	HIV1.25			
External regenerative resistor connection terminals	B1/⊕, B2	HIV1.25			
Ground terminal	⊖	HIV2.0 or higher			

■ Three-phase, 200 V

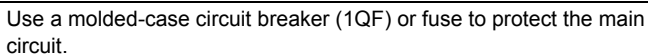
External Terminal Name	Terminal Symbols	SERVOPACK Model SGD V-														
		R70	R90	1R6	2R8	3R8	5R5	7R6	120	180	200	330	470	550	590	780
Main circuit power input terminals	L1, L2, L3	HIV1.25			HIV2.0					HIV3.5		HIV5.5	HIV8.0	HIV14.0	HIV22.0	
Control power input terminals	L1C, L2C	HIV1.25														
Servomotor connection terminals	U, V, W	HIV1.25			HIV2.0				HIV3.5	HIV5.5	HIV8.0	HIV14.0		HIV22.0		
External regenerative resistor connection terminals	B1/⊕, B2	HIV1.25							HIV2.0	HIV3.5	HIV5.5	HIV8.0		HIV22.0		
Ground terminal	⊖	HIV2.0 or higher														

■ Three-phase, 400 V

External Terminal Name	Terminal Symbols	SERVOPACK Model SGD <sub>V</sub> -									
		1R9	3R5	5R4	8R4	120	170	210	260	280	370
Main circuit power input terminals	L1, L2, L3	HIV1.25			HIV2.0		HIV3.5		HIV 5.5	HIV 8.0	HIV 14.0
Control power input terminals	24V, 0V	HIV1.25									
Servomotor connection terminals	U, V, W	HIV1.25			HIV2.0		HIV 3.5	HIV5.5		HIV 8.0	HIV 14.0
External regenerative resistor connection terminals	B1/⊕, B2 (B1, B2)	HIV1.25					HIV 2.0	HIV3.5		HIV 5.5	HIV 8.0
Ground terminal		HIV2.0 or higher									



### 3.3.3 Typical Main Circuit Wiring Examples



- The SERVOPACK connects directly to a commercial power supply; it is not isolated through a transformer or other device. Always use a molded-case circuit breaker (1QF) or fuse to protect the servo system from accidents involving different power system voltages or other accidents.

- The SERVOPACK does not have a built-in protective circuit for grounding.

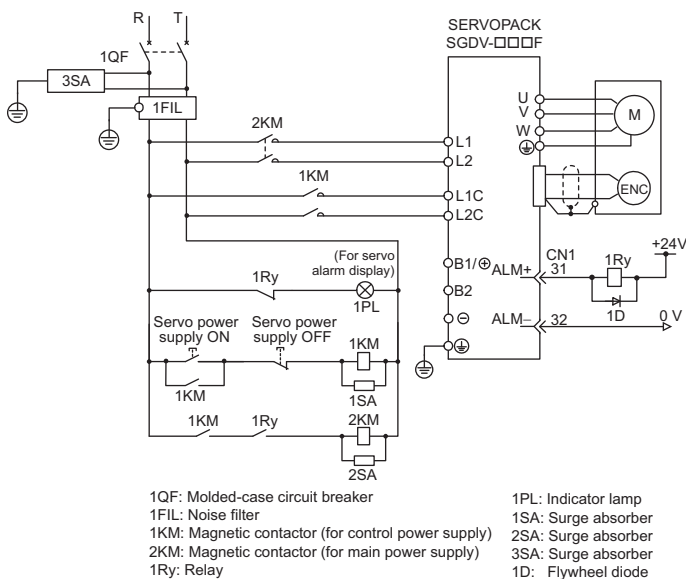
To configure a safer system, install a ground fault detector against overloads and short-circuiting, or install a ground fault detector combined with a molded-case circuit breaker.

Do not turn power ON and OFF frequently.

- The power supply in the SERVOPACK contains a capacitor, which causes a high charging current to flow when power is turned ON. Frequently turning power ON and OFF will cause the main circuit elements in the SERVOPACK to deteriorate.

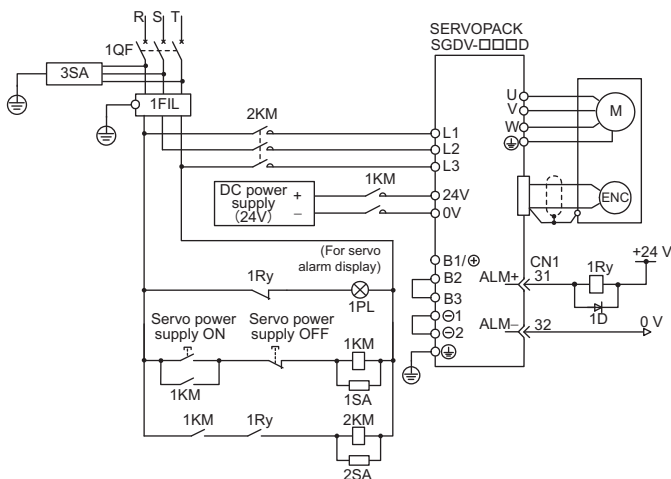
The following wiring examples show the  $\Sigma$ -V Series SGD V SERVOPACK (Analog pulse model).

■ Single-phase 100 V, SGD□-□□□F (SGDV-R70F, R90F, 2R1F, 2R8F)

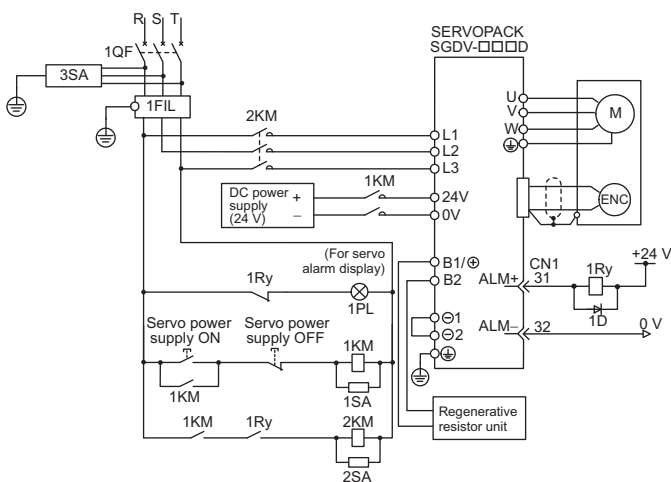




- SGDV-1R9D, 3R5D, 5R4D, 8R4D, 120D, 170D



1D: Flywheel diode



1D: Flywheel diode

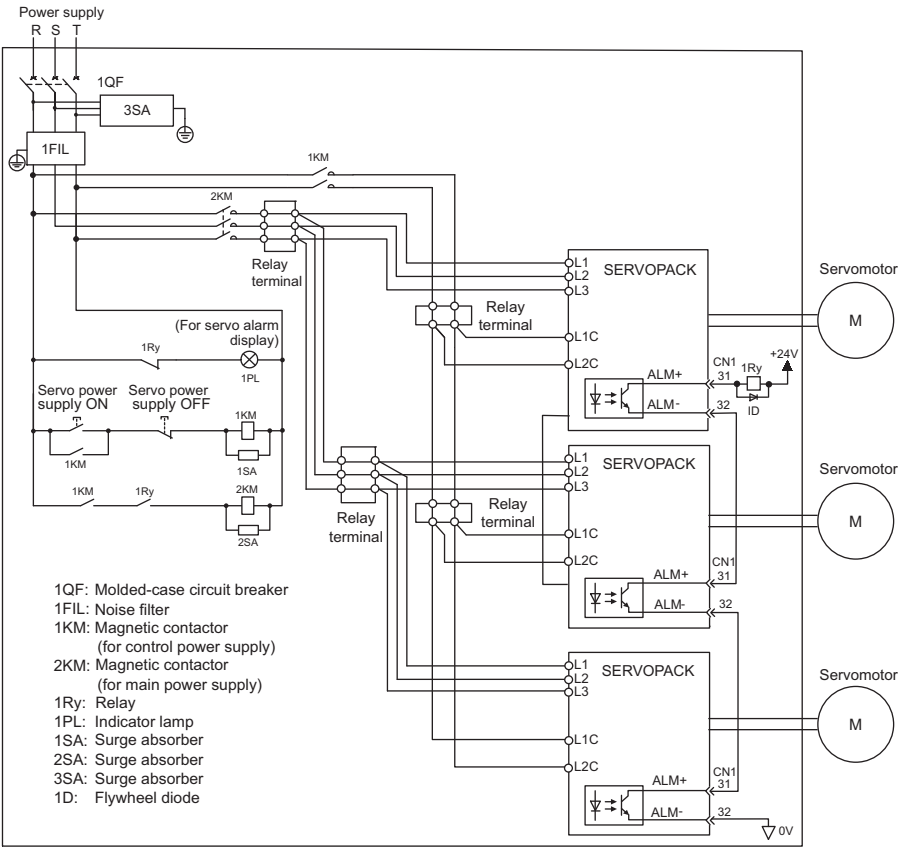
■ Precautions When Using More Than One SERVOPACK

This section shows an example of the wiring when more than one SERVOPACK is used and the precautions.

• Wiring Example (Analog pulse model)

Connect the alarm output (ALM) terminals for the three SERVOPACKs in series to enable alarm detection relay 1RY to operate.

When the alarm occurs, the ALM output signal transistor is turned OFF.



3.3.4 Wiring the Main Circuit Terminal Connector (Spring Type)

- Precautions

When using more than one SERVOPACK with a DC power supply, refer to these manuals here for the appropriate wiring, connections, and required settings.

- $\Sigma$ -V Series User's Manual  
Design and Maintenance Rotational Motor/Analog Voltage and Pulse Train Reference (SIEP S800000 45)
- $\Sigma$ -V Series User's Manual Design and Maintenance Rotational Motor/ MECHATROLINK-II Communications  
Reference (SIEP S800000 46)

**3.3.4** Wiring the Main Circuit Terminal Connector (Spring Type)

Two types of main circuit terminals are available: a connector type and a terminal screw type.

- SERVOPACKs with terminal screws:  
SGDV-180A, 200A, 330A, 470A, 550A, 590A, 780A, 8R4D, 120D, 170D, 210D, 260D, 280D, 370D
- SERVOPACKs with connectors:  
SGDV-R70F, R90F, 2R1F, 2R8F, R70A, R90A, 1R6A, 2R8A, 3R8A, 5R5A, 7R6A, 120A, 1R9D, 3R5D, 5R4D

A spring connector is used for SERVOPACKs with connectors. The following section describes how to wire the main circuit terminal using a connector.

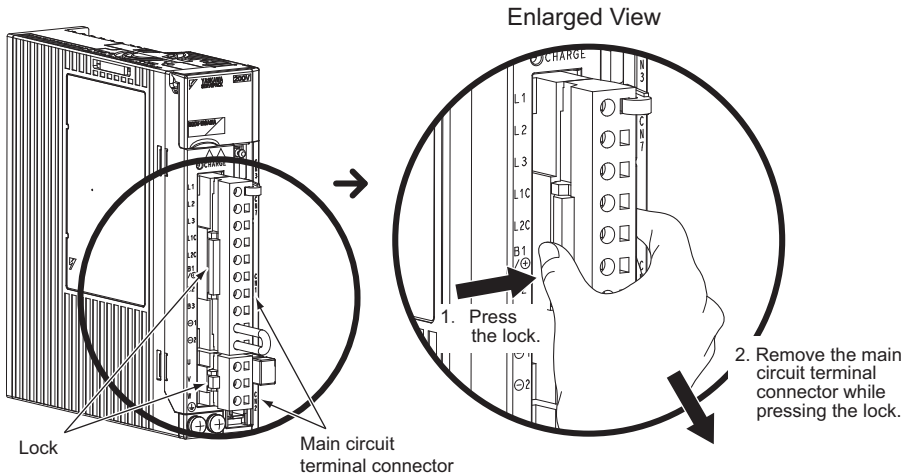


**CAUTION**

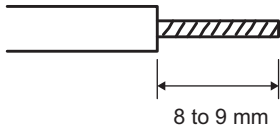
- Observe the following precautions when wiring main circuit terminal connectors.
  - Do not turn ON the power to the SERVOPACK until all wiring has been completed, including the main circuit terminal connectors.
  - Remove detachable main circuit terminal connectors from the SERVOPACK prior to wiring.
  - Insert only one main circuit cable per opening in the main circuit terminal connector.
  - Make sure that no part of the core wire comes into contact with (i.e., short-circuit) adjacent wires.

## ■ Wiring Procedure

1. Remove the main circuit terminal connector from the SERVOPACK.



2. Strip the end of the wires.



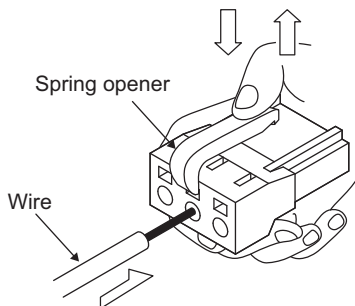
Applicable wire sizes:  
Refer to 3.3.2 SERVOPACK  
Main Circuit Wire Size.

3. Open the wire terminal on the terminal connector housing with a tool, using the following methods. Either method can be used to open the wire terminal.

## ■ Using a spring opener

Use the spring opener provided with the SERVOPACK to open the wire terminal as shown in the diagram.

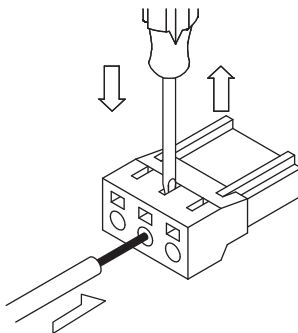
Note: The spring opener (1981045-1) made by Tyco Electronics AMP K.K. can also be used.



### 3.3.4 Wiring the Main Circuit Terminal Connector (Spring Type)

#### ■ Using a screwdriver

Use a commercially available flat-blade screwdriver with a blade width of 3.0 to 3.5 mm. Insert the screwdriver into the slot and press down firmly to open the wire terminal.



- 4.** Insert the wire core into the opening, and then secure the wire into position by removing the opener or screwdriver to close the opening.
- 5.** Make all the required connections in the same way.
- 6.** Attach the connector to the SERVOPACK.

## 3.4 Connecting Regenerative Resistors

This section describes how to connect regenerative resistors and set the regenerative resistor capacity. To learn how to select a regenerative resistor, and for detailed specifications, refer to *Σ-V Series Product Catalog* (KAEP S800000 42).

For more information on how to set the capacity of regenerative resistors, refer to *Σ-V Series User's Manual Design and Maintenance* (SIEP S800000 45/46).

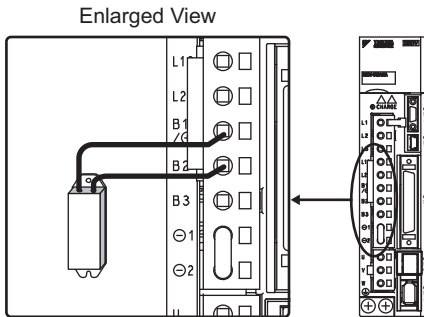
### ⚠ WARNING

- Be sure to connect the regenerative resistor correctly.  
Failure to observe this warning may result in fire or damage to the product.

### 3.4.1 Connecting Regenerative Resistor

- SERVOPACKs: Model SGD-V-R70F, R90F, 2R1F, 2R8F, R70A, R90A, 1R6A, 2R8A

Connect an external regenerative resistor between B1/⊕ and B2 terminals. After connecting a resistor, select the capacity.



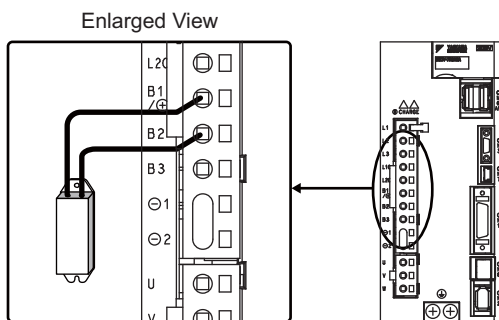


#### 3.4.1 Connecting Regenerative Resistor

- **SERVOPACKs:** Model SGD $\mathbf{V}$ -3R8A, 5R5A, 7R6A, 120A, 180A, 200A, 330A, 1R9D, 3R5D, 5R4D, 8R4D, 120D, 170D

Disconnect the wiring between the SERVOPACK's B2 and B3 terminals and connect an external regenerative resistor between the B1/⊕ and B2 terminals or between the B1 and B2 terminals.

Note: Be sure to take out the lead wire between the B2 and B3 terminals.



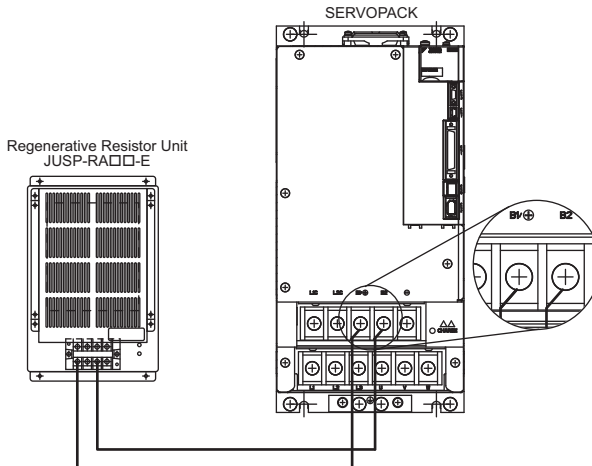
■ SERVOPACKs: Model SGDV-470A, 550A, 590A, 780A, 210D, 260D, 280D, 370D

No built-in regenerative resistor is provided, so the external regenerative resistor is required. The regenerative resistor units are as follow:

Main Circuit Power Supply	Applicable SERVOPACK Model SGDV	Applicable Regenerative Resistor Unit	Resistance ( $\Omega$ )	Specifications
Three-phase 200 V	470A	JUSP-RA04-E	6.25	25 $\Omega$ (220 W); 4 resistors in parallel
	550A, 590A, 780A	JUSP-RA05-E	3.13	25 $\Omega$ (220 W); 8 resistors in parallel
Three-phase 400 V	210D, 260D	JUSP-RA18-E	18	18 $\Omega$ (220 W); 2 resistors in series with 2 in parallel.
	280D, 370D	JUSP-RA19-E	14.25	28.5 $\Omega$ (220 W); 2 resistors in series with 4 in parallel.

Connect a regenerative resistor unit between B1/⊕ and B2 terminals.

When using a regenerative resistor unit, set Pn600 to 0W (factory setting).



# Safety Function

This chapter describes the safety functions.

4.1 Outline ..... 4-2

4.2 Hard Wire Base Block (HWBB) Function ..... 4-3

4.3 Safety Function Signal (CN8) Names and Functions ..... 4-4

4.4 Precautions When Not Using the Safety Function ..... 4-4

4.5 When Using the Safety Function ..... 4-5

### 4.1 Outline

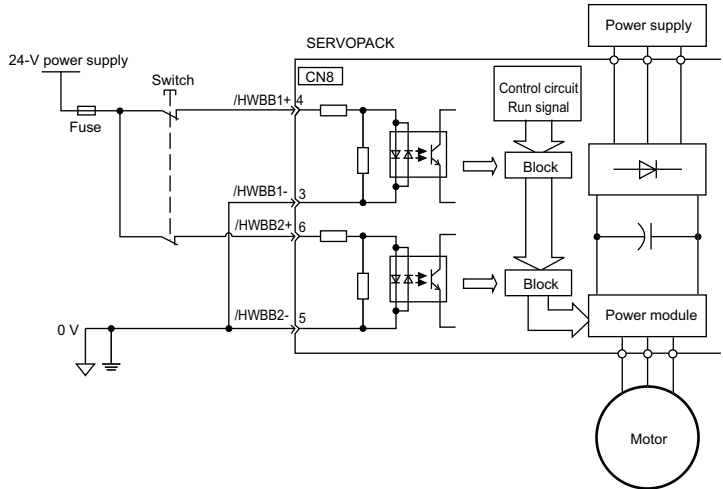
The safety function is incorporated in the SERVOPACK to reduce the risk associated with the machine by protecting workers from injury and by securing safe machine operation. Especially when working in hazardous areas inside the safeguard, as for machine maintenance, it can be used to avoid adverse machine movement.

The person who designs a system using the safety function (Hard Wire Baseblock function) must have full knowledge of the related safety standards and full understanding of the following manuals.

- $\Sigma$ -V Series User's Manual  
Design and Maintenance Rotational Motor/Analog Voltage and Pulse Train Reference (SIEP S800000 45)
- $\Sigma$ -V Series User's Manual  
Design and Maintenance Rotational Motor/ MECHATROLINK-II Communications Reference (SIEP S800000 46)

## 4.2 Hard Wire Base Block (HWBB) Function

The Hard Wire Base Block function (hereinafter referred to as HWBB function) is a safety function designed to baseblock the motor (shut off the motor current) by using the hardwired circuits: Each circuit for two channel input signals blocks the run signal to turn off the power module, and the motor current is shut off. (Refer to the diagram below.)



**Note:** For safety function signal connections, the input signal is the 0V common and the output signal is the source output. This is opposite to other signals described in this manual. To avoid confusion, the ON and OFF status of signals for safety functions are defined as follows:

- ON:** The state in which the relay contacts are closed or the transistor is ON and current flows into the signal line.
- OFF:** The state in which the relay contacts are open or the transistor is OFF and no current flows into the signal line.

### WARNING

- Perform risk assessment for the system and confirm that the safety requirements with the following standards are fulfilled before using the HWBB function.  
EN954-1 Category3  
IEC61508-1 to 4 SIL2

### 4.3 Safety Function Signal (CN8) Names and Functions

The following table shows the terminal layout of safety function signals (CN8).

Pin No.	Signal Name	Function	
1*	—	—	—
2*	—	—	—
3	/HWBB1-	Hard wire baseblock input 1	Hard wire baseblock input Baseblock (motor current off) when OFF
4	/HWBB1+		
5	/HWBB2-	Hard wire baseblock input 2	
6	/HWBB2+		
7	EDM1-	Monitored circuit status output 1	ON when the /HWBB1 and the /HWBB2 signals are input and the SERVOPACK enters a baseblock state.
8	EDM1+		

\* Do not use unused terminals. (connected to the internal circuits)

### 4.4 Precautions When Not Using the Safety Function

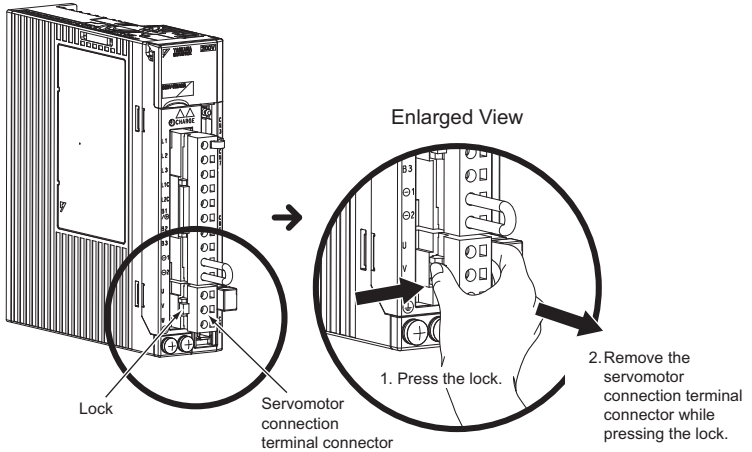
When not using the safety function or when performing a JOG operation, use the SERVOPACK with the safety function jumper connector (JZSP-CVH05-E, provided as an accessory) inserted. If the SERVOPACK is used without the jumper connector inserted into CN8, no current will flow to the motor and no torque will be output.

When Hbb is displayed on the panel operator and digital operator, the motor is base-blocked by the safety function. Check to see if the JZSP-CVH05-E jumper connector is correctly inserted into CN8.

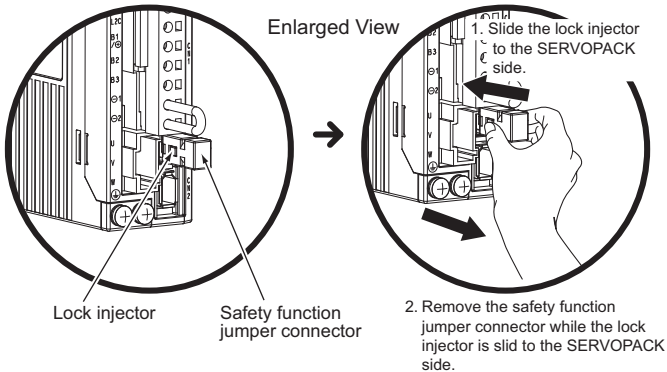
## 4.5 When Using the Safety Function

When using the safety function, remove the jumper connector for the safety function and connect a safety device using the following procedure.

1. Remove the servomotor connection terminal connector while pressing the lock.



2. Slide the lock injector of the safety function jumper connector to the SERVOPACK side to unlock and remove the safety function jumper connector.



Note: The safety function jumper connector may be damaged if it is removed without being unlocking.

3. Connect a safety device to CN8.

## Trial Operation (Checking Servomotor Operation)

This chapter describes how to perform trial operation.

5.1 Outline .....	5-2
5.2 Inspection and Checking before Trial Operation .....	5-2
5.3 JOG Operation Using a Panel Operator .....	5-5
5.4 JOG Operation Using a Digital Operator .....	5-7
5.5 JOG Operation Using SigmaWin+ .....	5-10



## 5.1 Outline

The trial operation described here is a JOG operation for servomotors not connected to machinery (without a load). The purpose of this trial operation is to check whether the SERVOPACK and servomotor are properly connected and whether the servomotor is operating normally.

To conduct trial operation executed from the host controller for the servomotor without load, or for the servomotor connected to the machine, refer to the following manuals.

- $\Sigma$ -V Series User's Manual Design and Maintenance Rotational Motor/Analog Voltage and Pulse Train Reference (SIEP S800000 45).
- $\Sigma$ -V Series User's Manual Design and Maintenance Rotational Motor/MECHATROLINK-II Communications Reference (SIEP S800000 46).

### CAUTION

- Conduct trial operation on the servomotor alone with the motor shaft disconnected from the machine to avoid any unexpected accidents. If it is unavoidable to perform trial operation while connected to a machine, then always make sure that an emergency stop can be immediately executed.

## 5.2 Inspection and Checking before Trial Operation

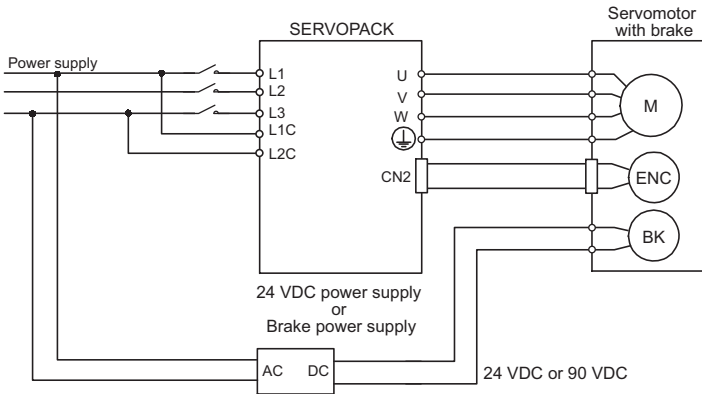
To ensure safe and correct trial operation, inspect and check the following items before starting trial operation.

### ■ Servomotors

Inspect and check the following items, and take appropriate measures before performing trial operation if any problem exists.

- Are all wiring and connections correct?
- Are all nuts and bolts securely tightened?
- If the servomotor has an oil seal, is the seal undamaged and is the motor oiled?
- If the servomotor has a brake, is the brake released beforehand? To release the brake, apply the specified voltage (24 VDC or 90 VDC). The following diagram shows an example of the circuit wiring needed to release the holding brake before a trial operation.

An example of the circuit wiring



- A 24 VDC power supply is not included.
- Brake power supply Input voltage of 200 V: LPSE-2H01-E  
Input voltage of 100 V: LPDE-1H01-E

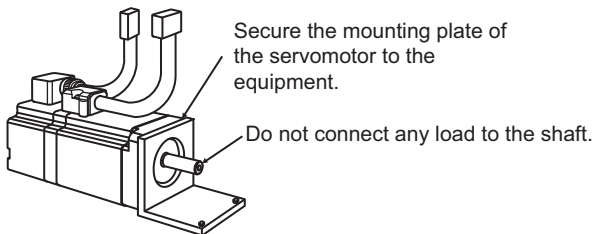
## SERVOPACKs

Inspect and check the following items, and take appropriate measures before performing trial operation if any problem exists.

- Are all installation, wiring and connections correct?
- Is the correct power supply voltage being supplied to the SERVOPACK?

## Installing the Servomotor and SERVOPACK

Install the servomotor and SERVOPACK according to the installation conditions.

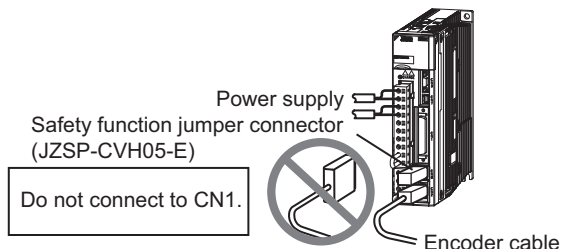


### <Note>

- Be sure to secure the servomotor to the equipment, or the servomotor may turn over when it starts rotating.
- Do not connect anything to the servomotor shaft.

### ■ Checking the Main Circuit Power Supply, Servomotor, and Encoder Wiring

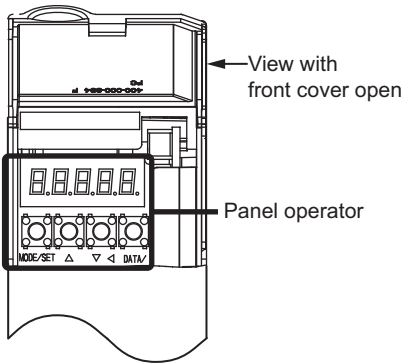
Once again, check the main circuit power supply, servomotor, and encoder wiring that was described in *Chapter 3 Wiring and Connection*. Perform a trial operation with the safety function jumper connector (JZSP-CVH05-E, provided as an accessory) inserted into the CN8 connector.



5.3 JOG Operation Using a Panel Operator


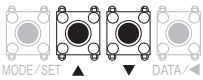
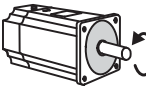
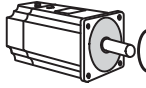

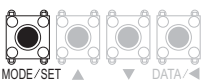

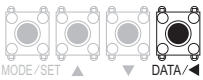


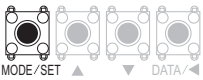
This section describes the procedure for executing a JOG operation using a panel operator.

The panel operator is located under the front cover of the SERVOPACK (analog pulse models only).



Step	Display after operation	Keys	Operation
1	<div><div>[-].Pot</div><div>↑↓ Alternate display</div><div>[-].not</div></div>		Turn ON the power to the SERVOPACK. The forward run prohibited (P-OT) or reverse run prohibited (N-OT) message is displayed. When the JOG operation is executed, P-OT and N-OT are automatically disabled.
2	<div><div>Fn000</div></div>	<div><div>MODE/SET ▲</div><div>▼ DATA/◀</div></div>	Press the MODE/SET Key to select the utility function mode.
3	<div><div>Fn002</div></div>	<div><div>MODE/SET ▲</div><div>▼ DATA/◀</div></div>	Press the Up (▲) or Down (▼) Cursor Key to select Fn002.
4	<div><div>[-].JOG</div></div>	<div><div>MODE/SET ▲</div><div>▼ DATA/◀</div></div>	Press the DATA/SHIFT Key for approximately one second.
5	<div><div>[-].JOG</div></div>	<div><div>MODE/SET ▲</div><div>▼ DATA/◀</div></div>	Press the MODE/SET Key. The servomotor power will turn ON.

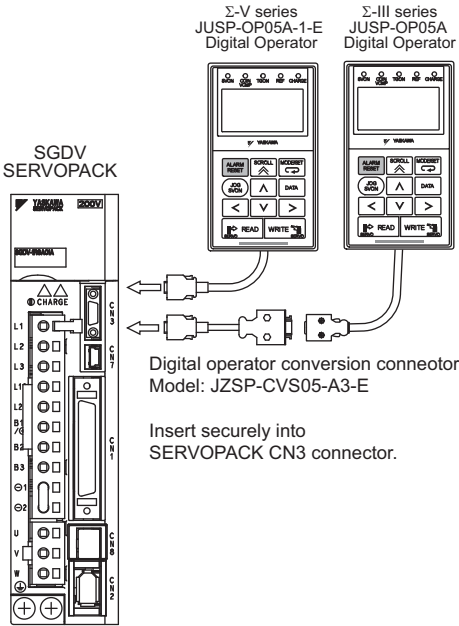
5 Trial Operation (Checking Servomotor Operation)

Step	Display after operation	Keys	Operation
6			<p>Press the Up Cursor Key to rotate the servomotor in the forward direction and press the Down Cursor Key to rotate it in reverse. The servomotor will operate while the key is being pressed. (The factory setting is 500 min<sup>-1</sup>.)</p> <div><span>Forward rotation</span></div> <div><span>Reverse rotation</span></div> <p>Confirm that the servomotor operation is correct. At the same time, carefully inspect the servomotor's condition and check the following points in particular. If a problem is found, correct it.</p> <ul style="list-style-type: none"><li>• Is there any unusual vibration?</li><li>• Is there any unusual sound?</li><li>• Is the temperature rising unusually high?</li></ul>
7			<p>Press the MODE/SET Key. The servomotor power will be OFF.</p> <p>Note: The servomotor can be turned OFF by pressing the DATA/SHIFT Key for approximately one second.</p>
8			<p>Press the DATA/SHIFT Key for approximately one second. "Fn002" is displayed again.</p>
9	<div> ↑ ↓ Alternate display </div>		<p>Press the MODE/SET Key to return to the initial display (step 1).</p>

# 5.4 JOG Operation Using a Digital Operator

This section describes the procedure for executing a JOG operation using a digital operator.

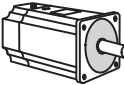
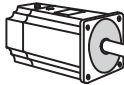
Connect the digital operator to the SERVOPACK CN3 connector.



The digital operator can be connected or removed while the SERVOPACK power is ON.

Step	Display after operation	Keys	Operation
1	<div>BB -PRM/MON-</div> <div>Un000= 00000</div> <div>Un002= 00000</div> <div>Un008= 0000000000</div> <div>Un00D= 0000000000</div>		Turn ON the power to the SERVO-PACK. A message saying that the file list is being loaded will appear and then the parameter/monitor mode will appear.
2	<div>BB -FUNCTION-</div> <div>Fn000:Alm History</div> <div>Fn002:JOG</div> <div>Fn003:Z-Search</div> <div>Fn004:Program JOG</div>	<div>MODERSET</div> <div>▲ ▼</div>	Press the <div>MODERSET</div> Key to view the main menu of the Utility Function mode. Press the <div>▲</div> Key or <div>▼</div> Key to select Fn002.

5 Trial Operation (Checking Servomotor Operation)

Step	Display after operation	Keys	Operation
3	<div>BB - JOG -</div> <div>Pn304=00500</div> <div>Un000= 00000</div> <div>Un002= 00000</div> <div>Un00D= 0000000000</div>	<div>DATA</div>	Press the <div>DATA</div> Key. The display changes to the execution display of Fn002.
4	<div>RUN - JOG -</div> <div>Pn304=00500</div> <div>Un000= 00000</div> <div>Un002= 00000</div> <div>Un00D= 0000000000</div>	<div>JOG SVON</div>	Press the <div>JOG SVON</div> Key. "RUN" is displayed as the status, and the servomotor power turns ON.
5	<div>RUN - JOG -</div> <div>Pn304=00500</div> <div>Un000= 00000</div> <div>Un002= 00000</div> <div>Un00D= 0000000000</div>	<div>^</div> <div>v</div>	<p>Press the <div>^</div> Key to rotate the servomotor in the forward direction and press the <div>v</div> Key to rotate it in reverse. The servomotor will operate while the key is being pressed. (The factory setting is 500 min<sup>-1</sup>.)</p> <div><div>Forward rotation</div> <div>Reverse rotation</div></div> <p>Confirm that the servomotor operation is correct. At the same time, carefully inspect the servomotor's condition and check the following points in particular. If a problem is found, correct it.</p> <ul style="list-style-type: none"><li>• Is there any unusual vibration?</li><li>• Are there any unusual sound?</li><li>• Is the temperature rising unusually high?</li></ul>
6	<div>BB - JOG -</div> <div>Pn304=00500</div> <div>Un000= 00000</div> <div>Un002= 00000</div> <div>Un00D= 0000000000</div>	<div>JOG SVON</div>	After confirming that the servomotor is running correctly, press the <div>JOG SVON</div> Key. "BB" is displayed as the status, and the servomotor power turns OFF.
7	<div>BB - FUNCTION -</div> <div>Fn000:Alm History</div> <div>Fn002:JOG</div> <div>Fn003:Z-Search</div> <div>Fn004:Program JOG</div>	<div>MODE/SET</div>	Press the <div>MODE/SET</div> Key to return to the main menu of the Utility Function mode.

Step	Display after operation	Keys	Operation
8	<div>BB                  —PRM/MON— Un000= 00000 Un002= 00000 Un008= 0000000000 Un00D= 0000000000</div>	<div>MODERSET ↺↻</div>	Press the <div>MODERSET ↺↻</div> Key twice to return to the initial display (step 1).

■ Alarm Display

An alarm is automatically displayed if a problem occurs for some reason. Refer to *Chapter 6 Troubleshooting* section and apply the appropriate measures.

A. 710	—ALARM—
A. 710	00001207196
1: 720	00000032651
2: 511	00000009043
3: ---	

■ Error Display

The following messages will be displayed if a communications error occurs between the SERVOPACK and the digital operator due to a connection problem such as poor connector contact. Check the connections and turn the power ON again. If the problem still persists, the digital operator or SERVOPACK must be replaced.

CPF00
COM-ERR(OP&SV)

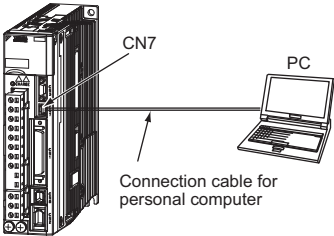



CPF01
COM-ERR(OP&SV)





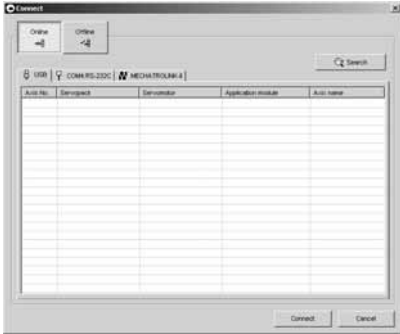


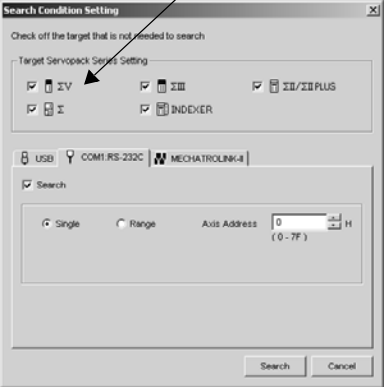

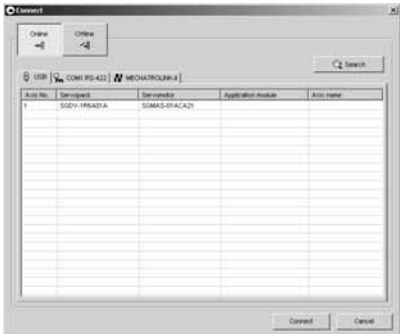
5.5 JOG Operation Using SigmaWin+

This section describes the procedure for executing a JOG operation using SigmaWin+.




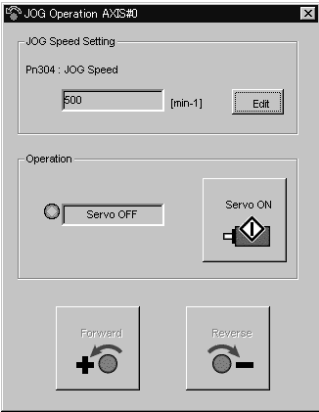
In the following example, test-run procedures are explained using the JOG operation window of Test Run on the main menu of SigmaWin+.

Step	Operation	Display
1	<ul style="list-style-type: none"><li>Connect a computer.</li></ul> Use a connection cable to connect a SERVOPACK to a computer which has SigmaWin+ installed. SERVOPACK  JZSP-CVS06-02-E	
2	<ul style="list-style-type: none"><li>Start SigmaWin+ and open the main window.</li></ul> (1) Turn ON the SERVOPACK. (2) Turn ON the computer. (3) Double click the YE_Applications folder on the desktop. (4) Double click the SigmaWin+ icon to display the SigmaWin+ startup screen.	 YE_Applications  SigmaWin+ English Edition  Startup Screen


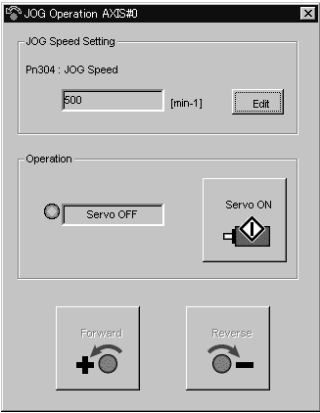

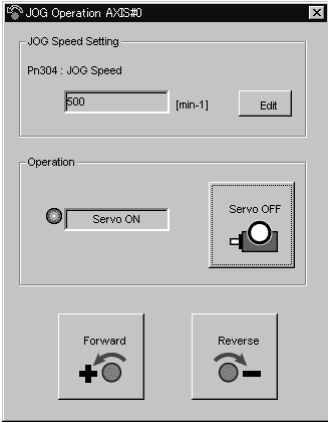
(cont'd)

Step	Operation	Display
2 (cont'd)	<p>(5) Once SigmaWin+ is started, the connection window is displayed.</p> <p>Note:  is used for operation with no SERVOPACK connected.</p> <p>Click  to search for the connected SERVOPACK.</p>	 <p>Connection Window</p>
	<p>(6) Search Condition Setting window is open.</p> <p>Select <math>\Sigma</math>-V(  ), and click  .</p> <p>A dialog box will open first to tell you a search has started, and then the search result will be shown in the connection window.</p> <p>Note: If the message, “Servopack not found” is displayed, refer to 2.2 <i>Selecting a SERVOPACK</i> of SigmaWin+ English Edition Online Manual (YE_Applications -&gt; Manual).</p>	 <p>Select only <math>\Sigma</math>-V</p> <p>Search Condition Setting Window</p>
	<p>(7) Select the SERVOPACK to be connected.</p> <p>Click  . (Place the cursor over the SERVOPACK to be connected, and then click on it.)</p> <p>The main window of SigmaWin+ will then open.</p>	



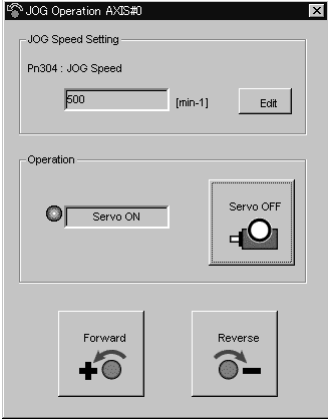

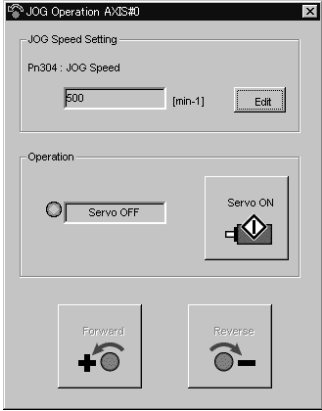

(cont'd)

Step	Operation	Display
3	<ul style="list-style-type: none"><li>Run test operation.</li></ul> <p>(1) Select Test Run first, and then select Jog (J) from the menu on the main window.</p>	<p>Test Run (R) → Jog (J)</p>  <p>Main Window</p>
	<p>(2) Warnings for the JOG operation window will be displayed. Read them and click</p>  .	 <p>Warnings for the JOG Operation Window</p>
	<p>(3) The JOG operation window is open.</p>	 <p>JOG Operation Window</p>

(cont'd)

Step	Operation	Display
4	<ul style="list-style-type: none"><li>Set the JOG speed The motor speed is set to 500 [min<sup>-1</sup>]. Click  if you need to change it.</li></ul>	
5	<ul style="list-style-type: none"><li>Servo ON Click . The display changes from <b>Servo OFF</b> to <b>Servo ON</b> and is lit in green.</li></ul>	

(cont'd)

Step	Operation	Display
6	<p>• Start JOG operation.</p> <p>When you click  the servomotor will rotate in the forward direction. When you click  it will rotate in reverse.</p> <p>Confirm that the servomotor operation is correct. At the same time, carefully inspect the servomotor's condition and check the following points in particular. If a problem is found, correct it.</p> <ul style="list-style-type: none"><li>• Is there any unusual vibration?</li><li>• Is there any unusual sound?</li><li>• Is the temperature rising unusually high?</li></ul>	
7	<p>• Servo OFF</p> <p>Click  .</p> <p>(Screen display will return to the display shown at step 4.)</p>	
8	<p>• Terminate JOG operation.</p> <p>Click  to end JOG operation.</p>	<p>You will return to the main window.</p>

Refer to the online manual for SigmaWin+ for details. Follow the steps below to view the online manual.

<How to view the online manual>

1. Turn ON the computer.
2. Open the YE\_Applications folder.
3. Open the Manual folder.
4. Open SigmaWin+ English Edition Online Manual.

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## Troubleshooting

This chapter describes the problems that can occur during setup and suggests measures for correcting them.

6.1 Troubleshooting of Alarms	6-2
6.2 Troubleshooting of Warnings	6-25
6.3 Troubleshooting Malfunction Based on Operation and Conditions of the Servomotor	6-30

6.1 Troubleshooting of Alarms

When an error occurs in SERVOPACKs, an alarm display such as A.□□□ and CPF□□ on the panel operator.

Refer to the following table to identify the cause of an alarm and the action to be taken.

For alarms not described here, refer to the following manuals.

- $\Sigma$ -V Series User's Manual Design and Maintenance Rotational Motor/Analog Voltage and Pulse Train Reference (SIEP S800000 45).
- $\Sigma$ -V Series User's Manual Design and Maintenance Rotational Motor/MECHATROLINK-II Communications Reference (SIEP S800000 46).

Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
A.020: Parameter Checksum Error 1 (The parameter data in the SERVOPACK is incorrect.)	The power supply voltage suddenly dropped.	Measure the power supply voltage.	Set the power supply voltage within the specified range, and set Fn005 to initialize the parameter.
	The power supply went OFF while changing a parameter setting.	Note the circumstances when the power supply went OFF.	Set Fn005 to initialize the parameter and then set the parameter again.
	The number of times that parameters were written exceeded the limit.	Were the parameters frequently changed through the host controller?	The SERVOPACK may be faulty. Repair or replace the SERVOPACK. Reconsider the method of writing parameters.
	Malfunction caused by noise from the AC power supply or grounding line, static electricity noise, etc.	Turn the power supply ON and OFF several times. If the alarm still occurs, there may be noise interference.	Take countermeasures against noise.
	Gas, water drops, or cutting oil entered the SERVOPACK and caused failure of the internal components.	Check the installation conditions.	The SERVOPACK may be faulty. Replace the SERVOPACK.
	A SERVOPACK fault occurred.	Turn the power supply ON and OFF several times. If the alarm still occurs, the SERVOPACK is faulty.	The SERVOPACK may be faulty. Replace the SERVOPACK.
A.021: Parameter Format Error 1 (The parameter data in the SERVOPACK is incorrect.)	The software version of SERVOPACK that caused the alarm is older than that of the written parameter.	Check Fn012 to see if the set software version agrees with that of the SERVOPACK. If not, an alarm may occur.	Write the parameter of another SERVOPACK of the same model with the same software version. Then turn the power OFF and then ON again.
	A SERVOPACK fault occurred.	—	The SERVOPACK may be faulty. Replace the SERVOPACK.

(cont'd)

Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
A.022: System Checksum Error 1 (The parameter data in the SERVOPACK is incorrect.)	The power supply voltage suddenly dropped.	Measure the power supply voltage.	The SERVOPACK may be faulty. Replace the SERVOPACK.
	The power supply went OFF while setting a utility function.	Note the circumstances when the power supply went OFF.	The SERVOPACK may be faulty. Replace the SERVOPACK.
	A SERVOPACK fault occurred.	Turn the power supply ON and OFF several times. If the alarm still occurs, the SERVOPACK is faulty.	The SERVOPACK may be faulty. Replace the SERVOPACK.
A.030: Main Circuit Detector Error	A SERVOPACK fault occurred.	—	The SERVOPACK may be faulty. Replace the SERVOPACK.
A.040: Parameter Setting Error 1 (The parameter setting was out of the allowable setting range.)	The SERVOPACK and servomotor capacities do not match each other.	Check the combination of SERVOPACK and servomotor capacities.	Select the proper combination of SERVOPACK and servomotor capacities.
	A SERVOPACK fault occurred.	—	The SERVOPACK may be faulty. Replace the SERVOPACK.
	The parameter setting is out of the specified range.	Check the setting ranges of the parameters that have been changed.	Set the parameter to a value within the specified range.
	The electronics gear ratio is out of the setting range.	Check the electronic gear ratio. The ratio must satisfy: $0.001 < (\text{Pn20E/Pn210}) < 4000$ .	Set the electronic gear ratio in the range: $0.001 < (\text{Pn20E/Pn210}) < 4000$ .
A.041: Encoder Output Pulse Setting Error	The encoder output pulse (Pn212) is out of the setting range and does not satisfy the setting conditions.	Check the parameter Pn212.	Set Pn212 to a correct value.
A.042: Parameter Combination Error	The speed of program JOG operation (Fn004) is lower than the setting range after having changed the electronic gear ratio (Pn20E/Pn210) or the servomotor.	Check that the detection conditions <sup>*1</sup> is satisfied.	Reduce the electronic gear ratio (Pn20E/Pn210).
	The speed of program JOG operation (Fn004) is lower than the setting range after having changed the setting of the program JOG movement speed (Pn533).	Check that the detection conditions <sup>*1</sup> is satisfied.	Increase the setting for the program JOG movement speed (Pn533).

$$*1. \quad \text{Pn533} [\text{min}^{-1}] \times \frac{2 (\text{encoder resolution})}{6 \times 10^5} \leq \frac{\text{Pn20E}}{\text{Pn210}}$$



(cont'd)

Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
A.042: Parameter Combination Error (cont'd)	The moving speed of advanced autotuning is lower than the setting range after having changed the electronic gear ratio (Pn20E/Pn210) or the servomotor.	Check that the detection conditions*1 is satisfied.	Reduce the electronic gear ratio (Pn20E/Pn210).
A.044: Fully-closed Loop Control Parameter Setting Error	The setting of the option module does not match with that of Pn002.3.	Check the settings of Pn002.3.	The setting of option module must be compatible with the setting of Pn002.3.
A.04A*2: Parameter Setting Error 2	For a 4-byte parameter bank, no registration in two consecutive bytes for two bank members.	—	Change the number of bytes for bank members to an appropriate value.
	The total amount of bank data exceeds 64. (Pn900 × Pn901 > 64)	—	Reduce the total amount of bank data to 64 or less.
A.050: Combination Error (The SERVOPACK and servomotor capacities do not correspond.)	The SERVOPACK and servomotor capacities do not match each other.	Check the capacities to see if they satisfy the following condition: (Servomotor capacity)/(SERVOPACK capacity) ≤ 1/4, or (Servomotor capacity)/(SERVOPACK capacity) ≤ 4.	Select the proper combination of SERVOPACK and servomotor capacities.
	An encoder fault occurred.	Replace the servomotor and see if the alarm occurs again.	Replace the servomotor (encoder).
	A SERVOPACK fault occurred.	—	The SERVOPACK may be faulty. Replace the SERVOPACK.
A.051: Unsupported Device Alarm	An unsupported serial converter unit, serial encoder, or external encoder is connected to the SERVOPACK.	Check the product specifications, and select the correct model.	Select the correct combination of units.
A.0b0: Cancelled Servo ON Command Alarm	After executing the utility function to turn ON the power to the motor, the Servo ON command was sent from the host controller.	—	Turn the SERVOPACK power supply OFF and then ON again.

\*1. 
$$\text{Pn533} [\text{min}^{-1}] \times \frac{2 \text{ (encoder resolution)}}{6 \times 10^5} \leq \frac{\text{Pn20E}}{\text{Pn210}}$$

\*2. These errors occur in SERVOPACKs using MECHATROLINK-II

(cont'd)

Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
A.100: Overcurrent or Heat Sink Overheated (An overcurrent flowed through the IGBT or heat sink of SERVOPACK overheated.)	Incorrect wiring or contact fault of main circuit cable or motor main circuit cable.	Check the wiring. Refer to <i>3.1 Main Circuit Wiring</i> (SIEP S800000 45/46).	Correct the wiring.
	Short-circuit or ground fault of main circuit cable or motor main circuit cable.	Check for short-circuits across the servomotor terminals, U, V, and W, or between the grounding and servomotor terminal U, V, or W. Refer to <i>3.1 Main Circuit Wiring</i> (SIEP S800000 45/46).	Some cables may be damaged. Replace damaged cables.
	Short-circuit or ground fault inside the servomotor.	Check for short-circuits across the servomotor terminals, U, V, and W on the SERVOPACK, or between the grounding and servomotor terminal U, V, or W. Refer to <i>3.1 Main Circuit Wiring</i> (SIEP S800000 45/46).	The servomotor may be faulty. Replace the servomotor.
	Short-circuit or ground fault inside the SERVOPACK.	Check for short-circuits across the servomotor connection terminals, U, V, and W on the SERVOPACK, or between the grounding and terminal U, V, or W. Refer to <i>3.1 Main Circuit Wiring</i> (SIEP S800000 45/46).	The SERVOPACK may be faulty. Replace the SERVOPACK.
	Incorrect wiring or contact fault of the regenerative resistor.	Check the wiring. Refer to <i>3.6 Connecting Regenerative Resistors</i> (SIEP S800000 45) or <i>3.7 Connecting Regenerative Resistors</i> (SIEP S800000 46).	Correct the wiring.
	The dynamic brake (DB: Emergency stop executed from the SERVOPACK) was frequently activated, or the DB overload alarm occurred.	Check the resistor power consumption monitor Un00B to see how many times the DB has been used. Or, check the alarm trace back monitor Fn000 to see if the DB overload alarm A.730 or A.731 was reported.	Change the SERVOPACK model, operation conditions, or the mechanism so that the DB does not need to be used so frequently.
	The generated regenerative energy exceeded the SERVOPACK regenerative energy processing capacity.	Check the regenerative load ratio monitor Un00A to see how many times the regenerative resistor has been used.	Check the operation condition including overload, and reconsider the regenerative resistor value.

(cont'd)

Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
A.100: Overcurrent or Heat Sink Overheated (An overcurrent flowed through the IGBT or heat sink of SERVOPACK overheated.) (cont'd)	The SERVOPACK regenerative resistance is too small.	Check the regenerative load ratio monitor Un00A to see how many times the regenerative resistor has been used.	Change the regenerative resistance value to a value larger than the SERVOPACK minimum allowable resistance value.
	A heavy load was applied while the servomotor was stopped or running at a low-speed.	Check to see if the operating conditions are outside servo drive specifications.	Reduce the load applied to the servomotor or increase the operation speed.
	Malfunction caused by noise interference.	Improve the wiring or installation environment, such as by reducing noise, and check to see if the alarm recurs.	Take countermeasures for noise, such as correct wiring of the FG. Use an FG wire size equivalent to the SERVOPACK main circuit wire size.
	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.300: Regeneration Error	Regenerative resistor capacity (Pn600) is set to a value other than 0 for a SGDVR70, -R90, -1R6, or -2R8 SERVOPACK, and an external regenerative resistor is not connected.	Check the external regenerative resistor connection and the value of the Pn600.	Connect the external regenerative resistor, or set Pn600 to 0 if no regenerative resistor is required.
	The jumper between the power supply terminals B2 and B3 is removed.	Confirm that a jumper is mounted between the power supply terminals B2 and B3.	Correctly mount a jumper.
	The external regenerative resistor is incorrectly wired, or is removed or disconnected.	Check the external regenerative resistor connection.	Correctly connect the external regenerative resistor.
	A SERVOPACK fault occurred.	—	While the main circuit power supply is OFF, turn the control power supply OFF and then turn ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.

(cont'd)

Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
A.320: Regenerative Overload	The power supply voltage exceeds the specified limit.	Measure the power supply voltage.	Set the power supply voltage within the specified range.
	Incorrect external regenerative resistance. Insufficient SERVOPACK capacity or regenerative resistor capacity. Or, regenerative power has been continuously flowing back.	Check the operation condition or the capacity using the capacity selection Software SigmaJunmaSize+, etc.	Change the regenerative resistance, regenerative resistor capacity, or SERVOPACK capacity. Reconsider the operation conditions using the capacity selection software SigmaJunmaSize+, etc.
	Regenerative power continuously flowed back because negative load was continuously applied.	Check the load to the servomotor during operation.	Reconsider the system including servo, machine, and operation conditions.
	The setting of parameter Pn600 is smaller than the external regenerative resistor's capacity.	Check the external regenerative resistor connection and the value of the Pn600.	Set the Pn600 to a correct value.
	The external regenerative resistance is too high.	Check the regenerative resistance.	Change the regenerative resistance to a correct value or use an external regenerative resistor of appropriate capacity.
	A SERVOPACK fault occurred.	—	The SERVOPACK may be faulty. Replace the SERVOPACK.
A.330: Main Circuit Power Supply Wiring Error (Detected when the power to the main circuit is turned ON.)	The regenerative resistor disconnected when the SERVOPACK power voltage was increased.	Measure the resistance of the regenerative resistor.	When using a regenerative resistor built in the SERVOPACK: Replace the SERVOPACK. When using an external regenerative resistor: Replace the external regenerative resistor.
	In the AC power input mode, DC power was supplied.	Check the power supply to see if it is a DC power supply.	Correct the settings to match the actual power supply specifications.
	In the DC power input mode, AC power was supplied.	Check the power supply to see if it is a AC power supply.	Correct the settings to match the actual power supply specifications.
	Regenerative resistor capacity (Pn600) is not set to 0 even though the regenerative resistor is disconnected.	Is the regenerative resistor connected? If it is, check the regenerative resistor capacity.	Set Pn600 to 0.
	A SERVOPACK fault occurred.	—	The SERVOPACK may be faulty. Replace the SERVOPACK.

(cont'd)

Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
A.400: Overvoltage (Detected in the SERVOPACK main circuit power supply section.)	<ul style="list-style-type: none"><li>• For 100 VAC SERVOPACKs: The AC power supply voltage exceeded 145 V.</li><li>• For 200 VAC SERVOPACKs: The AC power supply voltage exceeded 290 V.</li><li>• For 400 VAC SERVOPACKs: The AC power supply voltage exceeded 580 V.</li><li>• For 200 VAC SERVOPACKs with DC power supply input: The power supply voltage exceeded 410 V.</li><li>• For 400 VAC SERVOPACKs with DC power supply input: The power supply voltage exceeded 820 V.</li></ul>	Measure the power supply voltage.	Set AC/DC power supply voltage within the specified range.
	The power supply is unstable, or was influenced by a lightning surge.	Measure the power supply voltage.	Improve the power supply conditions by installing a surge absorber, etc. Then, turn the power supply ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
	Acceleration/deceleration was executed under the following conditions. <ul style="list-style-type: none"><li>• The AC power supply voltage of 100 VAC SERVOPACK was in the range between 115 V and 135 V.</li><li>• The AC power supply voltage of 200 VAC SERVOPACK was in the range between 230 V and 270 V.</li><li>• The AC power supply voltage of 400 VAC SERVOPACK was in the range between 480 V and 560 V.</li></ul>	Check the power supply voltage and the speed and torque during operation.	Set AC power supply voltage within the specified range.
	The external regenerative resistance is too high for the actual operation conditions.	Check the operation conditions and the regenerative resistance.	Select a regenerative resistance value appropriate for the operation conditions and load.

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Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
A.400: Overvoltage (Detected in the SERVOPACK main circuit power supply section.) (cont'd)	The moment of inertia ratio exceeded the allowable value.	Confirm that the moment of inertia ratio is within the allowable range.	Increase the deceleration time, or reduce the load.
	A SERVOPACK fault occurred.	—	Turn the control power OFF and then ON again while the main circuit power supply is OFF. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.410: Undervoltage (Detected in the SERVOPACK main circuit power supply section.)	<ul style="list-style-type: none"> <li>For 100 VAC SERVOPACKs: The power supply voltage is 49 V or less.</li> <li>For 200 VAC SERVOPACKs: The power supply voltage is 120 V or less.</li> <li>For 400 VAC SERVOPACKs: The power supply voltage is 240 V or less.</li> </ul>	Measure the power supply voltage.	Set the power supply voltage within the specified range.
	The power supply voltage dropped during operation.	Measure the power supply voltage.	Increase the power supply capacity.
	Occurrence of instantaneous power interruption.	Measure the power supply voltage.	When the instantaneous power cut hold time Pn509 is set, decrease the setting.
	The SERVOPACK fuse is blown out.	—	Repair or replace the SERVOPACK, connect an AC/DC reactor, and run the SERVOPACK.
	A SERVOPACK fault occurred.	—	The SERVOPACK may be faulty. Replace the SERVOPACK.
A.450: Main-Circuit Capacitor Overvoltage	A SERVOPACK fault occurred.	—	Replace the SERVOPACK.

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Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
A.510: Overspeed (The servomotor speed exceeds the maximum.)	The order of phases U, V, and W in the servomotor wiring is incorrect.	Check the servomotor wiring.	Confirm that the servomotor is correctly wired.
	A reference value exceeding the overspeed detection level was input.	Check the input value.	Reduce the reference value or adjust the gain.
	The motor speed exceeded the maximum.	Check the servomotor speed waveform.	Reduce the speed reference input gain, adjust the servo gain, or reconsider the operation conditions.
	A SERVOPACK fault occurred.	—	The SERVOPACK may be faulty. Replace the SERVOPACK.
A.511: Overspeed of Encoder Output Pulse Rate	The encoder output pulse output frequency exceeded the limit.	Check the encoder output pulse output setting.	Decrease the setting of the encoder output pulse (Pn212).
	The encoder output pulse output frequency exceeded the limit because the servomotor speed was too high.	Check the encoder output pulse output setting and servomotor speed.	Decrease the servomotor speed.
A.520: Vibration Alarm	Abnormal vibration was detected at the servomotor rotation speed.	Check for abnormal noise from the servomotor, and check the speed and torque waveform during operation.	Reduce the servomotor speed or reduce the speed loop gain (Pn100).
	The moment of inertia ratio (Pn103) value is greater than the actual value or is greatly changed.	Check the moment of inertia ratio.	Set the moment of inertia ratio (Pn103) to an appropriate value.
A.521: Autotuning Alarm (Vibration was detected while executing the advanced autotuning, one-parameter tuning, EasyFFT, or tuning-less function.)	The servomotor vibrated considerably while performing tuning-less function (factory setting).	Check the servomotor speed waveform.	Reduce the load so that the moment of inertia ratio falls within the allowable value, or raise the tuning level or reduce the gain level using the tuning-less function (Fn200).
	The servomotor vibrated considerably during advanced autotuning, one-parameter tuning, or EasyFFT.	Check the servomotor speed waveform.	Check the operation procedure of corresponding function and take a corrective action.

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Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
A.710: A.720: Overload A.710: High Load A.720: Low Load	Incorrect wiring or contact fault of servomotor and encoder.	Check the wiring.	Confirm that the servomotor and encoder are correctly wired.
	Operation beyond the overload protection characteristics.	Check the servomotor overload characteristics and executed run command.	Reconsider the load conditions and operation conditions. Or, increase the servomotor capacity.
	Excessive load was applied during operation because the servomotor was not driven due to mechanical problems.	Check the executed run command and servomotor speed.	Remove the mechanical problems.
	A SERVOPACK fault occurred.	—	The SERVOPACK may be faulty. Replace the SERVOPACK.
A.730: A.731: Dynamic Brake Overload (An excessive power consumption of dynamic brake was detected.)	The servomotor rotates because of external force.	Check the operation status.	Take measures to ensure the servomotor will not rotate because of external force.
	The rotating energy at a DB stop exceeds the DB resistance capacity.	Check the DB resistor power consumption monitor (Un00B) to see how many times the DB has been used.	Reduce the servomotor reference speed. Reduce the moment of inertia ratio. Reduce the number of times of the DB stop operation.
	A SERVOPACK fault occurred.	—	The SERVOPACK may be faulty. Replace the SERVOPACK.
A.740: Overload of Surge Current Limit Resistor (The main circuit power is turned ON/OFF too frequently.)	The inrush current limit resistor operation frequency at the main circuit power supply ON/OFF operation exceeds the allowable range.	—	Reduce the frequency of turning the main circuit power supply ON/OFF.
	A SERVOPACK fault occurred.	—	The SERVOPACK may be faulty. Replace the SERVOPACK.



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Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
<b>A.7A0:</b> <b>Heat Sink Overheated</b> (Detected when the heat sink temperature exceeds 100°C.)	The surrounding air temperature is too high.	Check the surrounding air temperature using a thermostat.	Decrease the surrounding air temperature by improving the SERVOPACK installation conditions.
	The overload alarm has been reset by turning OFF the power too many times.	Check the alarm trace back monitor (Fn000) to see if the overload alarm was reported.	Change the method for resetting the alarm.
	Excessive load or operation beyond the regenerative energy processing capacity.	Check the accumulated load ratio monitor Un009 to see the load during operation, and the regenerative load ratio monitor Un00A to see the regenerative energy processing capacity.	Reconsider the load and operation conditions.
	Incorrect SERVOPACK installation orientation or/and insufficient space around the SERVO-PACK.	Check the SERVOPACK installation conditions.	Install the SERVOPACK correctly as specified.
	A SERVOPACK fault occurred.	—	The SERVOPACK may be faulty. Replace the SERVO-PACK.
<b>A.7AB:</b> <b>Built-in Fan in SERVOPACK Stopped</b>	The fan inside the SERVOPACK stopped.	Check for foreign matter or debris inside the SERVO-PACK.	Remove foreign matter or debris from the SERVO-PACK. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
<b>A.810:</b> <b>Encoder Backup Error</b> (Detected on the encoder side) (Only when an absolute encoder is connected.)	Alarm occurred when the power to the absolute encoder was initially turned ON.	Check to see if the power was turned ON initially.	Set up the encoder (Fn008).
	The encoder cable disconnected, and connected again.	Check to see if the power was turned ON initially.	Confirm the connection and set up the encoder (Fn008).
	The power from both the control power supply (+5 V) and the battery power supply from the SERVO-PACK is not being supplied.	Check the encoder connector battery or the connector contact status.	Replace the battery or take similar measures to supply power to the encoder, and set up the encoder (Fn008).
	An absolute encoder fault occurred.	—	If the alarm cannot be reset by setting up the encoder again, replace the servomotor.
	A SERVOPACK fault occurred.	—	The SERVOPACK may be faulty. Replace the SERVO-PACK.

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Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
A.820: Encoder Checksum Error (Detected on the encoder side.)	An encoder fault occurred.	—	Set up the encoder again using Fn008. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor.
	A SERVOPACK fault occurred.	—	The SERVOPACK may be faulty. Replace the SERVO- PACK.
A.830: Absolute Encoder Battery Error (The absolute encoder battery voltage is lower than the specified value.)	The battery connection is incorrect.	Check the battery connec- tion.	Reconnect the battery.
	The battery voltage is lower than the specified value 2.7 V.	Measure the battery volt- age.	Replace the battery.
	A SERVOPACK fault occurred.	—	The SERVOPACK may be faulty. Replace the SERVO- PACK.
A.840: Encoder Data Error (Detected on the encoder side.)	A malfunction occurred in the encoder.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the ser- vomotor may be faulty. Replace the servomotor.
	Malfunction of encoder because of noise interfer- ence, etc.	—	Correct the wiring around the encoder by separating the encoder cable from the servomotor main circuit cable or by checking the grounding and other wiring.
A.850: Encoder Overspeed (Detected when the control power supply was turned OFF and then ON again.) (Detected on the encoder side.)	The servomotor was run- ning at 200 min <sup>-1</sup> or higher when the control power supply was turned ON.	Check the speed monitor (Un000) to confirm the ser- vomotor speed when the power is turned ON.	Reduce the servomotor speed to a value less than 200 min <sup>-1</sup> , and turn ON the control power supply.
	An encoder fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the ser- vomotor may be faulty. Replace the servomotor.
	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SER- VOPACK may be faulty. Replace the SERVOPACK.

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Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
A.860: Encoder Overheated (Only when an absolute encoder is connected.) (Detected on the encoder side.)	The ambient temperature around the servomotor is too high.	Measure the ambient tem- perature around the servo- motor.	The ambient temperature must be 40°C or less.
	The servomotor load is greater than the rated load.	Check the accumulated load ratio monitor (Un009) to see the load.	The servomotor load must be within the specified range.
	An encoder fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the ser- vomotor may be faulty. Replace the servomotor.
	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SER- VOPACK may be faulty. Replace the SERVOPACK.
A.8A0* <sup>3</sup> : External Encoder Error of Scale	Setting of the zero point position of absolute exter- nal scale failed because the servomotor rotated.	Before setting the zero point position, use the fully- closed feedback counter monitor (Un00E) to con- firm that the servomotor is not rotating.	The servomotor must be stopped while setting the zero point position.
	An external encoder fault occurred.	—	Replace the external encoder.
A.8A1* <sup>3</sup> : External Encoder Error of Module	An external encoder fault occurred.	—	Replace the external encoder.
	A serial converter unit fault occurred.	—	Replace the serial con- verter unit.
A.8A2* <sup>3</sup> : External Encoder Error of Sensor (Incremental)	An external encoder fault occurred.	—	Replace the external encoder.
A.8A3* <sup>3</sup> : External Encoder Error of Position (Absolute)	An absolute external encoder fault occurred.	—	The absolute external encoder may be faulty. Refer to the encoder manu- facture's instruction manual for corrective actions.
A.8A5* <sup>3</sup> : External Encoder Overspeed	The overspeed from the external encoder occurred.	—	Repair or replace the exter- nal encoder.
A.8A6* <sup>3</sup> : External Encoder Overheated	The overheat from the external encoder occurred.	—	Repair or replace the exter- nal encoder.

\*3. The alarm that may occur in a SERVOPACK with option module for fully-closed loop control.

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Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
A.b10: Speed Reference A/D Error (Detected when the servo is ON.)	A malfunction occurred in the speed reference input section.	—	Clear and reset the alarm and restart the operation.
	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SER- VOPACK may be faulty. Replace the SERVOPACK.
A.b11: Speed Reference A/D Data Error	A malfunction occurred in the speed reference input section.	—	Clear and reset the alarm and restart the operation.
	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SER- VOPACK may be faulty. Replace the SERVOPACK.
A.b20: Reference Torque Input Read Error (Detected when the servo is ON.)	A malfunction occurred in the reading section of the torque reference input.	—	Clear and reset the alarm and restart the operation.
	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SER- VOPACK may be faulty. Replace the SERVOPACK.
A.b31: Current Detection Error 1 (Phase-U)	The current detection cir- cuit for phase U is faulty.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SER- VOPACK may be faulty. Replace the SERVOPACK.
A.b32: Current Detection Error 2 (Phase-V)	The current detection cir- cuit for phase V is faulty.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SER- VOPACK may be faulty. Replace the SERVOPACK.
A.b33: Current Detection Error 3 (Current detector)	The detection circuit for the current is faulty.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SER- VOPACK may be faulty. Replace the SERVOPACK.
	The servomotor main cir- cuit cable is disconnected.	Check for disconnection of the motor main circuit cable.	Correct the servomotor wir- ing.
A.b6A <sup>*2</sup> : MECHATROLINK Communications ASIC Error 1	SERVOPACK MECHA- TROLINK communica- tion section fault.	—	Replace the SERVOPACK.

\*2. These errors occur in SERVOPACKs using MECHATROLINK-II

(cont'd)

Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
A.bF0: System Alarm 0	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.bF1: System Alarm 1	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.bF2: System Alarm 2	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.bF3: System Alarm 3	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.bF4: System Alarm 4	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.C10: Servo Overrun Detected (Detected when the servomotor power is ON.)	The order of phases U, V, and W in the servomotor wiring is incorrect.	Check the servomotor wiring.	Confirm that the servomotor is correctly wired.
	An encoder fault occurred.	—	If the alarm still occurs after turning the power OFF and then ON again, even though the servomotor is correctly wired, the servomotor may be faulty. Replace the servomotor.
	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.C80: Absolute Encoder Clear Error and Multi-turn Limit Setting Error	An encoder fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor.
	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.

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Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
A.C90: Encoder Communications Error	Contact fault of encoder connector or incorrect encoder wiring.	Check the encoder connector contact status.	Re-insert the encoder connector and confirm that the encoder is correctly wired.
	Encoder cable disconnection or short-circuit. Or, incorrect cable impedance.	Check the encoder cable.	Use the encoder cable with the specified rating.
	Corrosion caused by improper temperature, humidity, or gas Short-circuit caused by intrusion of water drops or cutting oil Connector contact fault caused by vibration.	Check the operating environment.	Improve the operating environmental conditions, and replace the cable. If the alarm still occurs, replace the SERVOPACK.
	Malfunction caused by noise interference.	—	Correct the wiring around the encoder to avoid noise interference (Separate the encoder cable from the servomotor main circuit cable, improve grounding, etc.)
	A SERVOPACK fault occurred.	—	Connect the servomotor to another SERVOPACK, and turn ON the control power. If no alarm occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.C91: Encoder Communications Position Data Error	The noise interference occurred on the input/output signal line because the encoder cable is bent and the sheath is damaged.	Check the encoder cable and connector.	Confirm that there is no problem with the encoder cable layout.
	The encoder cable is bundled with a high-current line or near a high-current line.	Check the encoder cable layout.	Confirm that there is no surge voltage on the encoder cable.
	The FG potential varies because of influence from machines on the servomotor side, such as the welder.	Check the encoder cable layout.	Properly ground the device to separate from the encoder FG.

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Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
A.C92: Encoder Communications Timer Error	Noise interference occurred on the input/output signal line from the encoder.	—	Take countermeasures against noise.
	Excessive vibration and shocks were applied to the encoder.	Check the operating environment.	Reduce the machine vibration or correctly install the servomotor.
	An encoder fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor.
	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.CA0: Encoder Parameter Error	An encoder fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor.
	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.Cb0: Encoder Echoback Error	The encoder wiring and contact are incorrect.	Check the encoder wiring.	Correct the encoder wiring.
	Noise interference occurred due to incorrect encoder cable specifications.	—	Use tinned annealed copper twisted-pair or shielded twisted-pair cable with a core of at least 0.12 mm <sup>2</sup> .
	Noise interference occurred because the wiring distance for the encoder cable is too long.	—	The wiring distance must be 20 m max.
	The FG potential varies because of influence from machines on the servomotor side, such as the welder.	Check the encoder cable and connector.	Make the grounding for the machine separately from encoder side FG.
	Excessive vibration and shocks were applied to the encoder.	Check the operating environment.	Reduce the machine vibration or correctly install the servomotor.

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Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
A.Cb0: Encoder Echo-back Error (cont'd)	An encoder fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor.
	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.CC0: Multi-turn Limit Disagreement	When using a direct-drive (DD) servomotor, the multi-turn limit value (Pn205) is different from that of the encoder.	Check the value of the Pn205.	Correct the setting of Pn205 (0 to 65535).
	The multi-turn limit value of the encoder is different from that of the SERVOPACK. Or, the multi-turn limit value of the SERVOPACK has been changed.	Check the value of the Pn205 of the SERVOPACK.	Execute Fn013 at the occurrence of alarm.
	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.CF1*3: Feedback Option Module Communications Error (Reception error)	Wiring of cable between serial converter unit and SERVOPACK is incorrect or contact is faulty.	Check the external encoder wiring.	Correct the cable wiring.
	The specified cable is not used between serial converter unit and SERVOPACK.	Confirm the external encoder wiring specifications.	Use the specified cable.
	Cable between serial converter unit and SERVOPACK is too long.	Measure the external encoder cable length.	Use 20 m cable max.
	Sheath of cable between serial converter unit and SERVOPACK is broken.	Check the external encoder cable.	Replace the cable.

\*3. The alarm that may occur in a SERVOPACK with option module for fully-closed loop control.



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Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
A.CF2*3: Feedback Option Module Communications Error (Timer stop)	Noise interferes with the cable between serial converter unit and SERVOPACK.	—	Correct the wiring around serial converter unit, e.g., separating input/output signal line from main circuit cable or grounding.
	A serial converter unit fault occurred.	—	Replace the serial converter unit.
	A SERVOPACK fault occurred.	—	Replace the SERVOPACK.
A.d00: Position Error Pulse Overflow (Position error exceeded the value set in the excessive position error alarm level (Pn520))	The contact in the servomotor U, V, and W wirings is faulty.	Check the motor main circuit cable connection.	Confirm that there is no contact fault in the motor wiring of encoder wiring.
	The frequency of the position reference pulse is too high.	Reduce the reference pulse frequency, and operate the SERVOPACK.	Reduce the position reference pulse frequency or reference acceleration. Or, reconsider the electronic gear ratio.
	The position reference acceleration is too fast.	Reduce the reference acceleration, and operate the SERVOPACK.	Apply the smoothing function, such as using position reference acceleration/ deceleration time constant (Pn216).
	Setting of the Pn520 (Excessive Position Error Alarm Level) is low against the operating condition.	Check the alarm level (Pn520) to see if it is set to an appropriate value.	Set the Pn520 to proper value.
	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.d01: Position Error Pulse Overflow Alarm at Servo ON	The /S_ON signal is to be turned ON when the number of position error pulses is greater than the set value of Pn526.	Check the error counter monitor (Un008) while the /S_ON signal is OFF.	Set position error pulses to be cleared while the /S_ON signal is OFF. Or, correct the excessive position error alarm level at servo ON (Pn526).

\*3. The alarm that may occur in a SERVOPACK with option module for fully-closed loop control.

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Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
A.d02: Position Error Pulse Overflow Alarm by Speed Limit at Servo ON	After a position error pulse has been input, Pn529 limits the speed if the /S_ON signal is turned ON. If Pn529 limits the speed in such a state, this alarm occurs when reference pulses are input and the number of position error pulses exceeds the value set for parameter Pn520 (Excessive Position Error Alarm Level).	—	Set position error pulses to be cleared while the /S_ON signal is OFF. Or, correct the excessive position error alarm level (Pn520). Or, adjust the speed limit level at servo ON (Pn529).
A.d10 <sup>*3</sup> : Motor-load Position Error Pulse Overflow	Motor rotation direction and external encoder installation direction are opposite.	Check the servomotor rotation direction and the external encoder installation direction.	Install the external encoder in the opposite direction, or reverse the setting of the external encoder usage method (Pn002.3).
	Mounting of the load (e.g., stage) and external encoder joint installation are incorrect.	Check the external encoder mechanical connection.	Check the mechanical joints.
A.E02 <sup>*2</sup> : MECHA- TROLINK-II Internal Synchronization Error 1	A parameter was changed by the digital operator or the personal computer during MECHATROLINK-II communications.	Confirm the way the parameters are edited.	Stop changing parameters using digital operator or personal computer during MECHATROLINK-II communications.
	MECHATROLINK-II transmission cycle fluctuated.	—	Remove the cause of transmission cycle fluctuation at host controller.
	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.E40 <sup>*2</sup> : MECHA- TROLINK-II Transmission Cycle Setting Error	Setting of MECHATROLINK-II transmission cycle is out of specifications range.	Check the MECHATROLINK-II transmission cycle setting.	Set the transmission cycle to the proper value.

\*2. These errors occur in SERVOPACKs using MECHATROLINK-II.

\*3. The alarm that may occur in a SERVOPACK with option module for fully-closed loop control.

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Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
A.E50*2: MECHATROLINK-II Synchronization Error	WDT data of host controller was not updated correctly.	Check the WDT data updating for the host controller.	Update the WDT data at the host controller correctly.
	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.E51*2: MECHATROLINK-II Synchronization Failed	WDT data of host controller was not updated correctly at the synchronization communications start, and synchronization communications could not start.	Check the WDT data updating for the host controller.	Update the WDT data at the host controller correctly.
	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.E60*2: MECHATROLINK-II Communications error (Reception error)	MECHATROLINK-II wiring is incorrect.	Check the MECHATROLINK-II wirings.	Correct the MECHATROLINK-II wiring. Connect the terminator correctly.
	MECHATROLINK-II data reception error occurred due to noise interference.	—	Take measures against noise. Check the MECHATROLINK-II communications cable and FG wiring and take measures such as adding ferrite core on the MECHATROLINK-II communications cable.
	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.E61*2: MECHATROLINK-II Transmission Cycle Error (Synchronization interval error)	MECHATROLINK-II transmission cycle fluctuated.	Check the MECHATROLINK-II transmission cycle setting.	Remove the cause of transmission cycle fluctuation at host controller.
	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.

\*2. These errors occur in SERVOPACKs using MECHATROLINK-II.

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Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
A.EA2*2: DRV Alarm 2 (SERVOPACK WDC error)	A parameter was changed by the digital operator or the personal computer during MECHATROLINK-II communications.	Confirm the way the parameters are edited.	Stop changing parameters using digital operator or personal computer during MECHATROLINK-II communications.
	MECHATROLINK-II transmission cycle fluctuated.	Check the MECHATROLINK-II transmission cycle setting.	Remove the cause of transmission cycle fluctuation at host controller.
	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.Eb1: Safety Function Signal Input Timing Error	The lag between activations of the input signals /HWBB1 and /HWBB2 for the HWBB function is ten second or more.	Measure the time lag between the /HWBB1 and /HWBB2 signals.	The output signal circuits or devices for /HWBB1 and /HWBB2 or the SERVOPACK input signal circuits may be faulty. Alternatively, the input signal cables may be disconnected. Repair or replace them.
A.ED1*2: Command Execution Timeout	A timeout error occurred when using an MECHATROLINK command.	Check the motor status when the command is executed.	Execute the SV_ON or SENS_ON command only when the motor is not running.
		Check the external encoder status when the command is executed.	Execute the SENS_ON command only when an external scale is connected.
A.F10: Main Circuit Cable Open Phase  (With the main power supply ON, voltage was low for more than 1 second in an R, S, or T phase.) (Detected when the main power supply was turned ON.)	The three-phase power supply wiring is incorrect.	Check the power supply wiring.	Confirm that the power supply is correctly wired.
	The three-phase power supply is unbalanced.	Measure the voltage at each phase of the three-phase power supply.	Balance the power supply by changing phases.
	A single-phase power is input without setting Pn00B.2 (power supply method for three-phase SERVOPACK) to 1 (single-phase power supply).	Check the power supply and the parameter setting.	Match the parameter setting to the power supply.
	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.

\*2. These errors occur in SERVOPACKs using MECHATROLINK-II.

(cont'd)

Alarm: Alarm Name	Cause	Investigative Actions	Corrective Actions
CPF00: Digital Operator Transmission Error 1	The contact between the digital operator and the SERVOPACK is faulty.	Check the connector contact.	Insert securely the connector or replace the cable.
	Malfunction caused by noise interference	—	Keep the digital operator or the cable away from noise sources.
CPF01: Digital Operator Transmission Error 2	A digital operator fault occurred.	—	Disconnect the digital operator and then re-connect it. If the alarm still occurs, the digital operator may be faulty. Replace the digital operator.
	A SERVOPACK fault occurred.	—	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.

## 6.2 Troubleshooting of Warnings

Refer to the following table to identify the cause of a warning and the action to be taken. Contact your Yaskawa representative if the problem cannot be solved by the described corrective action.

For warnings not described here, refer to the following manuals.

- $\Sigma$ -V Series User's Manual Design and Maintenance Rotational Motor/Analog Voltage and Pulse Train Reference (SIEP S800000 45).
- $\Sigma$ -V Series User's Manual Design and Maintenance Rotational Motor/MECHATROLINK-II Communications Reference (SIEP S800000 46).

Warning: Warning Name	Situation at Warning Occurrence	Cause	Corrective Actions
A.900: Position Error Pulse Overflow	Wiring of the servomotor U, V, or W line is incorrect.	Check the wiring of the cable for motor main circuit.	Check whether there is any loose connection in motor wiring or encoder wiring.
	The SERVOPACK gain is too low.	Check the SERVOPACK gain.	Increase the servo gain by using the function such as advanced autotuning.
	The position reference pulse frequency is too high.	Lower the position reference pulse frequency.	Lower the position reference pulse frequency or the position reference acceleration, or correct the electronic gear ratio.
	The position reference acceleration is too high.	Lower the position reference acceleration.	Apply a smoothing function, such as a position reference acceleration/deceleration time constant (Pn216).
	The excessive position error alarm level (Pn520) is too low for the operating conditions.	Check the excessive position error alarm level (Pn520).	Set an appropriate value for the Pn520.
	A SERVOPACK fault occurred.	-	Turn the power supply OFF and then ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.901: Position Error Pulse Overflow Alarm at Servo ON	When the /S_ON signal was OFF, the servomotor moved without cleaning the counter for position error pulses. The number of position error pulses exceeded the maximum number of pulses allowed.	-	Set Pn200.2 to 0 to clear the number of position error pulses when the /S_ON signal is OFF. Or set an appropriate value for the excessive position error warning level at servo ON (Pn528) when the /S_ON signal is ON.

(cont'd)

Warning: Warning Name	Situation at Warning Occurrence	Cause	Corrective Actions
A.910: Overload Warning before alarm A710 or A720 occurs	The servomotor or encoder wiring is incorrect or the connection is faulty.	Check the wiring.	Correct the servomotor and encoder wiring if they are wrong.
	The servomotor is in excess of the overload protective characteristics.	Check the overload characteristics of the servomotor and reference input.	Reconsider the load and operation conditions. Or, check the servomotor capacity.
	The servomotor is not driven due to a mechanical factor and the operating load has become excessive.	Check the reference input and motor speed.	Improve the mechanical factor.
	A SERVOPACK fault occurred.	-	The SERVOPACK may be faulty. Replace the SERVOPACK.
A.911: Vibration	Unusual vibration was detected while the motor was rotating.	Check whether unusual sound is generated from the motor, and check the speed, and torque waveform of the motor.	Lower the motor rotation speed or lower the servo gain by using the function such as one-parameter tuning.
	The moment of inertia ratio (Pn103) is larger than the actual value or greatly changes.	Check the moment of inertia ratio.	Set an appropriate value for the moment of inertia (Pn103).
A.920: Regenerative Overload: Warning before the alarm A320 occurs	The power supply voltage is in excess of the specified range.	Measure the power supply voltage.	Set the power supply voltage within the specified range.
	The external regenerative resistance, servo amplifier capacity, or regenerative resistor capacity is insufficient or a continuous regenerative state occurs.	Check the operating conditions or capacity using the capacity selection software SigmaJunmaSize+, etc.	Change the regenerative resistance, regenerative resistor capacity, or SERVOPACK capacity. Reconsider the operating conditions using the capacity selection software SigmaJunmaSize+, etc.
	Regenerative power continuously flowed back because negative load was continuously applied.	Check the load on the servomotor during operation.	Reconsider the system including the servo, machine, and operation conditions.

(cont'd)

Warning: Warning Name	Situation at Warning Occurrence	Cause	Corrective Actions
A.921: Dynamic Brake Overload: Warning before the alarm A.731 occurs	The servomotor is driven by an external force.	Check the operat- ing conditions.	Do not drive the motor with external force.
	The rotating energy at a DB stop exceeds the DB resistance capacity.	Check the operat- ing frequency of the DB with power con- sumed by DB resis- tance monitor (Un00B).	<ul style="list-style-type: none"> <li>• Reduce the servomotor reference speed.</li> <li>• Reduce the moment of inertia.</li> <li>• Reduce the number of times of the DB stop oper- ation.</li> </ul>
	A SERVOPACK fault occurred.	—	The SERVOPACK may be faulty. Replace the SERVO- PACK.
A.930: Absolute Encoder Battery Error (The absolute encoder battery voltage is lower than the specified value.) (Only when an absolute encoder is connected.)	The battery connec- tion is incorrect.	Check the battery connection.	Reconnect the battery.
	The battery voltage is lower than the speci- fied value 2.7 V.	Measure the battery voltage.	Replace the battery.
	A SERVOPACK fault occurred.	—	The SERVOPACK may be faulty. Replace the SERVO- PACK.
A.941: Change of Parameters Requires Restart	Parameters that require the restart have been changed.	—	Turn OFF the power and ON again.
A.94A*: Data Setting Warning 1 (Parameter Num- ber Error)	Disabled parameter number was used.	—	Use the correct parameter number.
A.94B*: Data Setting Warning 2 (Out of Range)	Attempted to send val- ues outside the range to the command data.	—	Set the value of the parameter within the allowable range.
A.94C*: Data Setting Warning 3 (Calculation Error)	Calculation result of set value is incorrect.	—	Set the value of the parameter within the allowable range.
A.94D*: Data Setting Warning 4 (Parameter Size)	Parameter size set in command is incorrect.	—	Use the correct parameter size.

\* These warnings occur in SERVOPACKs using MECHATROLINK-II.



(cont'd)

Warning: Warning Name	Situation at Warning Occurrence	Cause	Corrective Actions
A.94E*: Data Setting Warning 5 (Latch mode error)	Latch mode error is detected.	—	Change the setting value of Pn850 or the LT_MOD data for the LTMOD_ON com- mand sent by the host con- troller to the proper value.
A.95A*: Command Warning 1	Command sending condition is not satis- fied.	—	Send a command after com- mand sending condition is satisfied.
A.95B*: Command Warning 2	SERVOPACK received unsupported command.	—	Do not sent an unsupported command.
A.95D*: Command Warning 4	Command sending condition for latch- related commands is not satisfied.	—	Send a command after command sending condi- tion is satisfied.
A.95E*: Command Warning 5	Subcommand sending condition is not satis- fied.	—	Send a command after com- mand sending condition is satisfied.
A.95F*: Command Warning 6 (Undefined Com- mand)	Undefined command was sent.	—	Do not use an undefined command.
A.960*: MECHA- TROLINK Com- munications Warning	MECHATROLINK-II wiring is incorrect.	Confirm the wiring.	Correct the MECHA- TROLINK-II wiring. Or, connect a terminal to the terminal station.
	MECHATROLINK-II data reception error occurred due to noise interference.	Confirm the installation conditions.	Take measures against noise. Check the MECHA- TROLINK-II communica- tions cable and FG wiring and take measures such as adding ferrite core on the MECHATROLINK-II com- munications cable.
	A SERVOPACK fault occurred.	—	A fault occurred in the SER- VOPACK. Repair or replace the SER- VOPACK.

\* These warnings occur in SERVOPACKs using MECHATROLINK-II.

(cont'd)

Warning: Warning Name	Situation at Warning Occurrence	Cause	Corrective Actions
A.971: Undervoltage	<ul style="list-style-type: none"> <li>• For 100 VAC SER-VOPACKs: The AC power supply voltage is 60 V or below.</li> <li>• For 200 VAC SER-VOPACKs: The AC power supply voltage is 140 V or below.</li> <li>• For 400 VAC SER-VOPACKs: The AC power supply voltage is 280 V or below.</li> </ul>	Measure the power supply voltage.	Use a power supply voltage within the specified range.
	The power supply voltage dropped during operation.	Measure the power supply voltage.	Increase the power supply capacity.
	An instantaneous power failure occurred.	Measure the power supply voltage.	Lower the instantaneous power cut hold time (Pn509).
	The fuse in the SERVOPACK is burned out.	—	Replace the SERVOPACK and connect an AC/DC reactor to the SERVOPACK.
	A SERVOPACK fault occurred.	—	The SERVOPACK may be faulty. Replace the SERVOPACK.

6.3 Troubleshooting Malfunction Based on Operation and Conditions of the Servomotor

Troubleshooting for the malfunctions based on the operation and conditions of the servomotor is provided in this section.

Be sure to turn OFF the servo system before troubleshooting items shown in bold lines in the table.

For problems not described here, refer to the following manuals.

- Σ-V Series User's Manual Design and Maintenance Rotational Motor/Analog Voltage and Pulse Train Reference (SIEP S800000 45).
- Σ-V Series User's Manual Design and Maintenance Rotational Motor/MECHATROLINK-II Communications Reference (SIEP S800000 46).

Problem	Probable Cause	Investigative Actions	Corrective Actions
Servomotor Does Not Start	The control power supply is not ON.	Check voltage between power supply terminals.	Correct the power circuit.
	The main circuit power supply is not ON.	Check the voltage between power supply terminals.	Correct the power circuit.
	Wiring of I/O signal connector CN1 faulty or disconnected.	Check if the connector CN1 is properly inserted and connected.	Correct the connector CN1 connection.
	Servomotor or encoder wiring disconnected.	Check the wiring.	Correct the wiring.
	Overloaded	Run under no load and check the load status.	Reduce load or replace with larger capacity servomotor.
	Speed/position references not input	Check reference input pins.	Input speed/position references correctly.
	Setting for Pn50A to Pn50D "Input Signal Selection" is incorrect.	Check settings of parameters Pn50A to Pn50D.	Correct the settings for Pn50A to Pn50D "Input Signal Selection."
	Encoder type differs from parameter setting (Pn002.2).	Check setting of parameter Pn002.2.	Set parameter Pn002.2 to the encoder type being used.
	Servo ON (/S-ON) input signal stays OFF.	Check settings of parameters Pn50A.0 and Pn50A.1.	Set the parameters to turn the Servo ON (/S-ON) input signal ON.
	/P-CON input function setting is incorrect.	Check parameter Pn000.1.	Set parameters to match the application.

(cont'd)

Problem	Probable Cause	Investigative Actions	Corrective Actions
Servomotor Does Not Start (cont'd)	SEN input is OFF.	Check the ON/OFF status of the SEN input.	If using an absolute encoder, turn the SEN input signal ON.
	Reference pulse mode selection is incorrect.	Check the Pn200.0 setting and the reference pulse status.	Match the Pn200.0 setting and the reference pulse status.
	Speed control: Speed reference input is incorrect.	Check V-REF and SG to confirm if the control method and the input are agreed.	Correct the control mode selection parameter, or the input.
	Torque control: Torque reference input is incorrect.	Check T-REF and SG to confirm if the control method and the input are agreed.	Correct the control mode selection parameter, or the input.
	Position control: Reference pulse input is incorrect.	Check Pn200.0 reference pulse form or sign + pulse signal.	Correct the control mode selection parameter, or the input.
	Position error pulse clear (/CLR) input is turned ON.	Check /CLR input pins (CN1-14 and -15).	Turn /CLR input signal OFF.
	The forward run prohibited (P-OT) and reverse run prohibited (N-OT) input signals are turned OFF.	Check P-OT or N-OT input signal.	Turn P-OT or N-OT input signal ON.
	The safety input signal (/HWBB1 or /HWBB2) remains OFF.	Check the /HWBB1 or /HWBB2 input signal.	Set the /HWBB1 or /HWBB2 input signal to ON. When not using the safety function, mount the safety function jumper connector (provided as an accessory) on the CN8.
	A SERVOPACK fault occurred.	—	Replace the SERVOPACK.
Servomotor Moves Instantaneously, and then Stops	Servomotor wiring is incorrect.	Check the servomotor wiring.	Correct the wiring.
	Encoder wiring is incorrect.	Check the encoder wiring.	Correct the wiring.
Servomotor Speed Unstable	Wiring connection to servomotor is defective.	Check connections of main circuit cable (phases-U, -V, and -W) and encoder connectors.	Tighten any loose terminals or connectors.

(cont'd)

Problem	Probable Cause	Investigative Actions	Corrective Actions
Servomotor Rotates Without Reference Input	Speed control: Speed reference input is incorrect.	Check V-REF and SG to confirm if the control method and the input are agreed.	Correct the control mode selection parameter, or the input signal.
	Torque control: Torque reference input is incorrect.	Check T-REF and SG to confirm if the control method and the input are agreed.	Correct the control mode selection parameter, or the input signal.
	Speed reference offset is incorrect.	The SERVOPACK offset is adjusted incorrectly.	Adjust the SERVOPACK offset.
	Position control: Reference pulse input is incorrect.	Check Pn200.0 reference pulse form or sign + pulse signal.	Correct the control mode selection parameter, or the input signal.
	A SERVOPACK fault occurred.	—	Replace the SERVOPACK.
Dynamic Brake Does Not Operate	Improper Pn001 setting	Check the setting of parameter Pn001.0.	Correct the parameter setting.
	DB resistor disconnected	Check if excessive moment of inertia, motor overspeed, or DB frequently activated occurred.	Replace the SERVOPACK, and lighten the load.
	DB drive circuit fault	—	There is a defective component in the DB circuit. Replace the SERVOPACK.
Abnormal Noise from Servomotor	The servomotor largely vibrated during execution of tuning-less function.	Check the servomotor speed waveform.	Reduce the load so that the moment of inertia ratio becomes within the allowable value, or increase the load level or lower the tuning level for the tuning-less level setting (Fn200).
	Mounting is not secured.	Check if there are any loose mounting screws.	Tighten the mounting screws.
		Check if there is misalignment of couplings.	Align the couplings.
		Check if there are unbalanced couplings.	Balance the couplings.
	Bearings are defective.	Check for noise and vibration around the bearings.	Replace the servomotor.
	Vibration source at the driven machine	Check for any foreign matter, damage, or deformations on the machinery's movable parts.	Contact the machine manufacturer.

(cont'd)

Problem	Probable Cause	Investigative Actions	Corrective Actions
Abnormal Noise from Servomotor (cont'd)	Noise interference due to incorrect input/output signal cable specifications	The input/output signal cables must be tinned annealed copper twisted-pair or shielded twisted-pair cables with a core of 0.12 mm <sup>2</sup> min.	Use the specified input signal wires.
	Noise interference due to length of input/output signal cable.	Check the length of the input/output cable.	The input/output cable length must be no more than 3 m.
	Noise interference due to incorrect encoder cable specifications.	The encoder cable must be tinned annealed copper twisted-pair or shielded twisted-pair cables with a core of 0.12 mm <sup>2</sup> min.	Use the specified encoder cable.
	Noise interference due to length of encoder cable wiring	Check the length of the encoder cable.	The encoder cable must be no more than 20 m.
	Noise interference due to damaged encoder cable	Check if the encoder cable is damaged or bent.	Replace the encoder cable and modify the encoder cable layout.
	Excessive noise to the encoder cable	Check if the encoder cable is bundled with high-current line or near a high-current line.	Correct the encoder cable layout so that no surge is applied.
	FG potential varies because of influence of machines such as welders at the servomotor.	Check if the machines are correctly grounded.	Ground machines correctly, and prevent diversion to the FG at the PG side.
	SERVOPACK pulse counting error due to noise interference	Check if there is noise interference on the input/output signal line from the encoder.	Take measures against noise in the encoder wiring.
	Excessive vibration and shock to the encoder	Check if vibration from the machine occurred or servomotor installation is incorrect (mounting surface accuracy, fixing, alignment, etc.).	Reduce vibration from the machine, or secure the servomotor installation.
	An encoder fault occurred.	—	Replace the servomotor.

(cont'd)

Problem	Probable Cause	Investigative Actions	Corrective Actions
Servomotor Vibrates at Frequency of Approx 200 to 400 Hz	Unbalanced servo gains	Check to see if the servo gains have been correctly adjusted.	Execute the advanced auto-tuning.
	Speed loop gain value (Pn100) too high.	Check the speed loop gain value (Pn100). Factory setting: Kv = 40.0 Hz	Reduce the speed loop gain (Pn100).
	Position loop gain value (Pn102) too high.	Check the position loop gain value (Pn102). Factory setting: Kp = 40.0/s	Reduce the position loop gain (Pn102).
	Incorrect speed loop integral time constant (Pn101) setting	Check the speed loop integral time constant (Pn101). Factory setting: Ti = 20.0 ms	Correct the speed loop integral time constant (Pn101) setting.
	Incorrect moment of inertia ratio data (Pn103)	Check the moment of inertia ratio setting (Pn103).	Correct the moment of inertia ratio (Pn103) setting.
High Rotation Speed Overshoot on Starting and Stopping	Unbalanced servo gains	Check to see if the servo gains have been correctly adjusted.	Execute the advanced auto-tuning.
	Speed loop gain value (Pn100) too high	Check the speed loop gain value (Pn100). Factory setting: Kv = 40.0 Hz	Reduce the speed loop gain (Pn100).
	Position loop gain value (Pn102) too high	Check the position loop gain value (Pn102). Factory setting: Kp = 40.0/s	Reduce the position loop gain (Pn102).
	Incorrect speed loop integral time constant (Pn101) setting	Check the speed loop integral time constant (Pn101). Factory setting: Ti = 20.0 ms	Correct the speed loop integral time constant setting (Pn101).
	Incorrect moment of inertia ratio data (Pn103)	Check the moment of inertia ratio setting (Pn103).	Correct the moment of inertia ratio setting (Pn103).
Absolute Encoder Position Difference Error (The position saved in the host controller when the power was turned OFF is different from the position when the power was next turned ON.)	Noise interference due to improper encoder cable specifications	The encoder cable must be tinned annealed copper twisted-pair or shielded twisted-pair cables with a core of 0.12 mm <sup>2</sup> min.	Use encoder cable with the specified specifications.

(cont'd)

Problem	Probable Cause	Investigative Actions	Corrective Actions
Absolute Encoder Position Difference Error (The position saved in the host controller when the power was turned OFF is different from the position when the power was next turned ON.) (cont'd)	Noise interference due to length of encoder cable.	Check the encoder cable length.	The encoder cable length must be no more than 20 m.
	Noise interference due to damaged encoder cable	Check if the encoder cable is bent or if its sheath is damaged.	Replace the encoder cable and correct the encoder cable layout.
	Excessive noise interference at the encoder cable	Check if the encoder cable is bundled with a high-current line or near high-current line.	Change the encoder cable layout so that no surge is applied.
	FG potential varies because of influence of machines such as welders at the servomotor.	Check if the machines are correctly grounded.	Ground machines correctly, and prevent diversion to the FG at the PG side.
	SERVOPACK pulse counting error due to noise interference	Check if there is noise interference on the input/output signal line from the encoder.	Take measures against noise in the encoder wiring.
	Excessive vibration and shock to the encoder	Check if vibration from the machine occurred or servomotor installation is incorrect (mounting surface accuracy, fixing, alignment, etc.).	Reduce vibration from the machine, or secure the servomotor installation.
	An encoder fault occurred.	—	Replace the servomotor.
	A SERVOPACK fault occurred. (The pulse count does not change.)	—	Replace the SERVOPACK.
	Host controller multi-turn data reading error	Check the error detection at the host controller.	Correct the error detection section of the host controller.
		Check if the host controller is executing data parity checks.	Execute a multi-turn data parity check.
		Check noise in the input/output signal line between the SERVOPACK and the host controller.	Take measures against noise, and again execute a multiturn data parity check.



(cont'd)

Problem	Probable Cause	Investigative Actions	Corrective Actions
Overtravel (OT)	Forward or reverse run prohibited signal is input.	Check the external power supply (+24 V) voltage for the input signal.	Correct the external power supply (+24 V) voltage.
		Check if the overtravel limit switch operates properly.	Correct the overtravel limit switch.
		Check if the overtravel limit switch is wired correctly.	Correct the overtravel limit switch wiring.
	Forward or reverse run prohibited signal malfunctioning.	Check the fluctuation of the input signal external power supply (+24 V) voltage.	Stabilize the external power supply (+24 V) voltage.
		Check if the overtravel limit switch operates correctly.	Stabilize the operation of the overtravel limit switch.
		Check if the overtravel limit switch wiring is correct. (check for damaged cables or loose screws.)	Correct the overtravel limit switch wiring.
	Incorrect forward or reverse run prohibited signal (P-OT/N-OT) allocation (parameters Pn50A.3, Pn50B.0)	Check if the P-OT signal is allocated in Pn50A.3.	If another signal is allocated in Pn50A.3, select P-OT.
		Check if the N-OT signal is allocated in Pn50B.0.	If another signal is allocated in Pn50B.0, select N-OT.
	Incorrect servomotor stop method selection	Check Pn001.0 and Pn001.1 when the servomotor power is OFF.	Select a servo mode stop method other than "coast to stop."
		Check Pn001.0 and Pn001.1 when in torque control.	Select a servo mode stop method other than "coast to stop."
Improper Position to Stop by Overtravel (OT) Signal	Improper limit switch position and dog length	—	Install the limit switch at the appropriate position.
	The overtravel limit switch position is too short for the coasting distance.	—	Install the overtravel limit switch at the appropriate position.
Position Error (Without Alarm)	Noise interference due to improper encoder cable specifications	The encoder cable must be tinned annealed copper twisted-pair or shielded twisted-pair cable with a core of 0.12 mm <sup>2</sup> min.	Use encoder cable with the specified specifications.
	Noise interference due to length of encoder cable	Check the encoder cable length.	The encoder cable length must be no more than 20 m.
	Noise influence due to damaged encoder cable	Check if the encoder cable is bent or if its sheath is damaged.	Replace the encoder cable and correct the encoder cable layout.
	Excessive noise interference to encoder cable	Check if the encoder cable is bundled with a high-current line or near a high-current line.	Change the encoder cable layout so that no surge is applied.


(cont'd)

Problem	Probable Cause	Investigative Actions	Corrective Actions
Position Error (Without Alarm) (cont'd)	FG potential varies because of influence of machines such as welders at the servomotor.	Check if the machines are correctly grounded.	Ground machines correctly, and prevent diversion to the FG at the PG side.
	SERVOPACK pulse count error due to noise	Check if the input/output signal line from the encoder is influenced by noise.	Take measures against noise in the encoder wiring.
	Excessive vibration and shock to the encoder	Check if vibration from the machine occurred or servomotor installation is incorrect (mounting surface accuracy, fixing, alignment, etc.).	Reduce the machine vibration or mount the servomotor securely.
	Unsecured coupling between machine and servomotor	Check if a position error occurs at the coupling between machine and servomotor.	Secure the coupling between the machine and servomotor.
	Noise interference due to improper I/O signal cable specifications	The I/O signal cable must be twisted-pair or shielded twisted-pair cable with a core of 0.12 mm <sup>2</sup> min. and tinned annealed copper twisted wire.	Use input signal cable with the specified specifications.
	Noise interference due to length of I/O signal cable	Check the I/O signal cable length.	The I/O signal cable length must be no more than 3 m.
	An encoder fault occurred. (The pulse count does not change.)	—	Replace the servomotor.
Servomotor Overheated	A SERVOPACK fault occurred.	—	Replace the SERVOPACK.
	Ambient temperature too high	Measure the servomotor ambient temperature.	Reduce the ambient temperature to 40°C or less.
	Servomotor surface dirty	Visually check the surface.	Clean dust and oil from the surface.
	Servomotor overloaded	Check the load status with monitor.	If overloaded, reduce load or replace with larger capacity servomotor.

# Revision History

The revision dates and numbers of the revised manuals are given at the bottom of the back cover.


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# AC Servo Drives

# $\Sigma$ -V Series

## USER'S MANUAL

## Setup

## Rotational Motor

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